Published June 15, 1943 Serial No. 35,394

ALIEN PROPERTY CUSTODIAN

METHOD OF MIXING OR GRANULATING OF PULVERULENT AND PLASTIC MATERIALS OF ALL KINDS

Joseph Eirich, Hardheim, and Ludwig Eirich, deceased, late of Hardheim, Germany, by Gustav Eirich, Ludwig Eirich, Walburga Eirich, Maria Hollerbach, Rosa Eirich, Johanna Eirich and Anna Eirich, heirs at law, Hardheim, Germany; vested in the Alien Property Custodian

Application filed August 8, 1935

This invention relates to a method of mixing or granulating of pulverulent and plastic materials of all kinds, in an intermittent or continuous operation.

The gist of the method of mixing or granulating is that the material is cut, worked, combed repeatedly, stirred, and moved in many directions, in a mixing machine with tools resembling rakes, forks, or knives, arranged eccentrically to the axis of the mixing machine. The tools which move eccentrically with respect to the centre of the mixing disk, are moved in circular lines which form loops in the material and, by the repeated rolling-over of the string-like portions of the material, impart intense movement to the content of the mixer, effecting thereby a repeated and thorough working and mixing of the material, without requiring any operation resembling that of a pug mill.

According to the invention, the material which may be, for instance, dry or moist, pulverulent or viscous, is spread on a rotary, flat and reciprocating or stationary support, for instance, a disk or a mixing bowl, and treated with the rake, fork, or knife like tools.

Various kinds of moist clay may be mixed rapidly and at a small power demand. For viscous material, knives are preferred since they demand little power at high velocity.

The material may be mixed and held in motion positively until it has been rolled into granular condition in many directions on the support by the rake like tools. Homogeneous material is mixed with a binder and with hygroscopic materials which per se do not cooperate, at a proportion sufficient for the granulation of the material, or the material is moistened.

Since the angular position of the tools with respect to the mixer axis varies continuously, the formation of globules is comparatively rapid if moisture enough has been added.

Materials which can be treated are clay and other plastic substances, with or without addition of color, artificial manure, thermoplastic substances, refractory materials, etc., of any desired composition and corresponding percentage of moisture, are mixed thoroughly in a single operation and shaped to globules.

Furthermore, for granulating the material, it may be mixed with substances increasing its strength, such as solution of water glass, adhesives, waste sulphite lye, hygroscopic salts, for instance, calcium chlorate, magnesium chlorate, cements, or the like, or with liquids other than water, for instance, salt solutions, hydrocarbons, oils, tars, or the like. The materials and additions are mixed in the mixing device in which also occurs the granulation. As mixing and granulation occur in the same machine, and in a single operation, the time required for performing it is shortened quite considerably.

The use of a single machine for mixing and granulating is particularly important in the case of plastic substances, which undergo a chemical conversion and become dry rapidly by chemical binding of the liquids they contain. The mixing operation must not be interrupted during the short period, and at the rapid granulation, and mixing and granulation must not be performed in separate machines.

Thermoplastic materials, for instance Leuna nitre which melts at 140°, can also be granulated by the method according to the invention. As the granulated materials solidify rapidly, it is necessary that the velocity at which the mixing tools, or the rotary disk, or both, rotate, should be increased substantially.

The grain size of the granulated material is regulated by the operation of the mixing machine, i. e., by varying the velocity at which the support rotates by speeding up or slowing down, or by shortening or lengthening the period of treatment for the same number of revolutions per minute.

The grain size can also be regulated by varying the adjustment of the combs or fork prongs at the mixing tools, i. e., by placing the prongs higher or lower, or by varying the angular position of the prongs with respect to each other, or by varying the interstices between the prongs.

Furthermore, the size of the granulate globules can be regulated by varying the moisture content or the adhesive strength of the mixture to be granulated.

Larger globules which may form upon the granulation, are broken up by the rotating fork prongs, and by prolonged rotation of the disk while when small globules form, the agglomeration is accelerated and favored by longer duration of the treatment, i. e., by rotation of the support for a longer period.

The machine can be charged with material to a comparatively high level without the formation of lumps which cannot be moved, in front of the tools, and cause trouble, because the rake like tools do not shift the material, as full wings or blades would do, but move through the material, cut it up, and subdivide and repeatedly overturn the material.

In Figs. 1–13, the mixing device for performing the method is shown in several embodiments.

Figs. 1 and 2 illustrate diagrammatically and in plan view a mixing disk with rake like tools.

Fig. 3 shows a rake like tool in elevation.

Fig. 4 is a plan view of the tool shown in Fig. 3.

Fig. 5 is an end elevation of the tool shown in Fig. 3.

Figs. 6 and 7 show a tool with adjustable rods and knives.

Figs. 8–10 show modifications of the rake-like tool.

Fig. 11 shows, by way of example, the transverse adjustment of the bars or knives.

Figs. 12 and 13 show a circular holder for a set of knives.

Referring now to Fig. 1, n is a rotary mixing disk which may have a central discharge opening, and v are rotary shafts arranged eccentrically to the axis of the disk n, to which shafts the rake, comb or knife-like tools m are secured.

If, as in the case of fire clay, further kneading and compression of the material is required, kneading and mixing tools s with solid blades are provided besides the rake-like tools m, as shown in Fig. 2. Between the tools m, arms m_1 with blades or scrapers may be provided.

Figs. 3–5 show a tool in which a holder b is secured to an arm c which is movable and may be springy. The holder b and a clip b_1 which is adapted to be screwed on, are equipped each with a circular depression into which the arm c engages. Narrow bars or knives a are arranged on the holder b, and rigidly connected to the holder, or mounted for adjustment transversely or vertically. The prongs a may also be arranged in serrations a_1 which resemble the teeth of a saw.

The transverse adjustment of the knives a appears from Fig. 11. The holder may be provided with a slot w in which the knives a are mounted for adjustment with a block z and equipped with set screws.

Figs. 6 and 7 show a device in which the ends of the bars or knives a are adjusted by turning about their longitudinal axis so that the bars or knives can be held at any desired angle to the material, and the effective area of the bars or knives varied. Bores for the reception of the cylindrical ends f of the bars a are provided in the holder b and the adjusted bars are held by set screws e.

Fig. 8 shows a tool in which the ends of bars a are connected by a transverse bar e_1 which detaches the material from the bottom of the mixing reservoir or bowl, the detached material flowing through the interstices between the bars a and being broken up and aerated, if required.

Figs. 9 and 10 show a rake with upright prongs or bars a which are slightly curved. The fork holder proper b which moves over the mixing disk like a scraper, detaching and lifting the material, so that it flows through between the prongs a in broken-up condition, is arranged at the lower end of the rake.

Figs. 12 and 13 show an example of a circular holder for a set of knives. The holder comprises an annular or frame-like body t with arms t_1 and a boss for securing it on the arm c.

The knives a, any number of which may be arranged at any desired pitch, are mounted adjustably on the frame or body t, and on the spokes t_1 so that the position of the knives can be altered as required for placing their cutting edges in position to cut the material or the knives act more or less with their sides, detaching and breaking up small strips.

The holder may rotate at high velocity and in this case its knives perform a very long cut. It is also suitable for breaking up liquids, i. e., for emulgation.

GUSTAV EIRICH.
LUDWIG EIRICH.
WALBURGA EIRICH.
MARIA HOLLERBACH.
ROSA EIRICH.
JOHANNA EIRICH.
ANNA EIRICH.
Heirs at Law of Ludwig Eirich, Deceased.
JOSEPH EIRICH.

PUBLISHED

JUNE 15, 1943.

BY A. P. C.

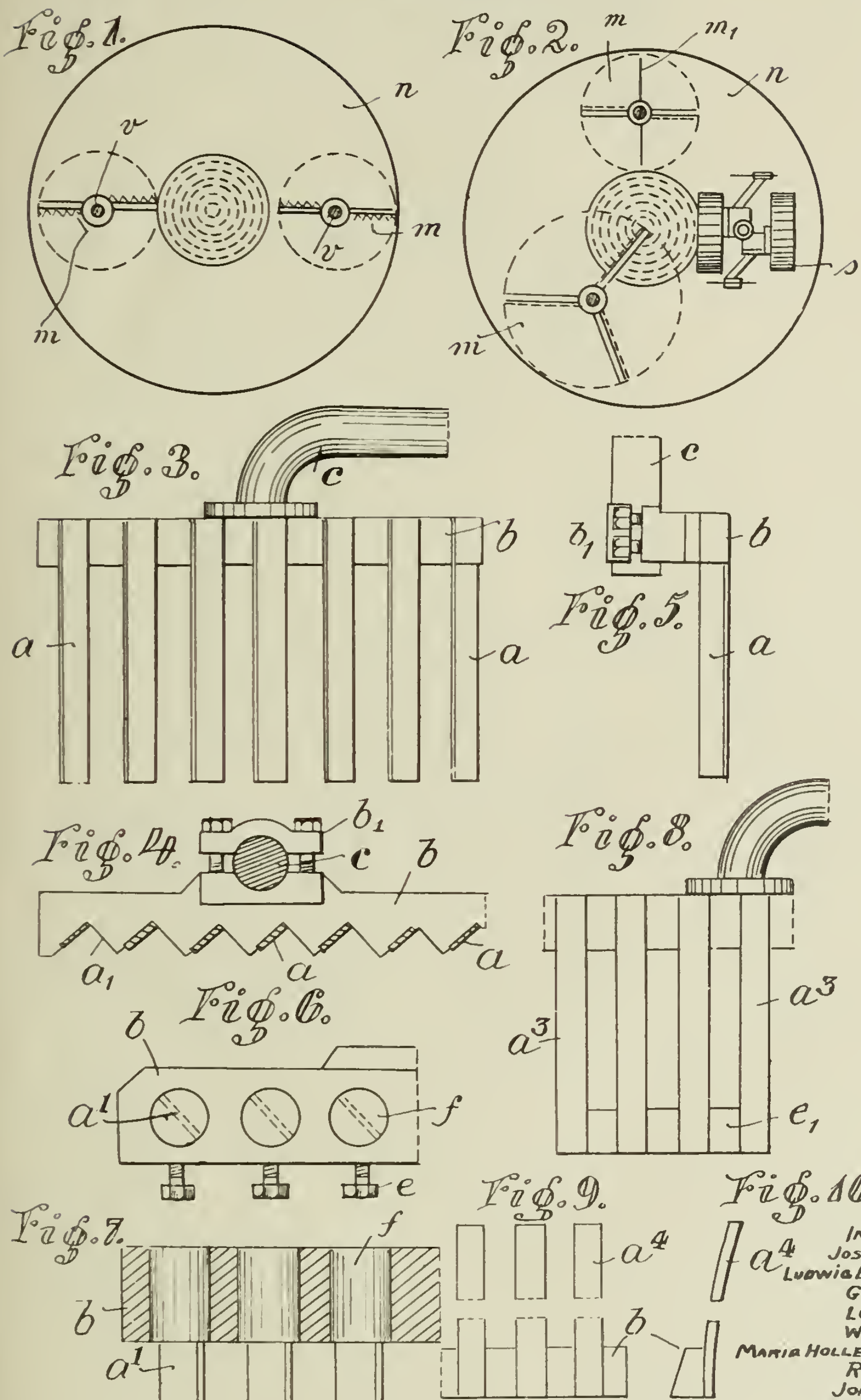
J. EIRICH ET AL

METHOD OF MIXING OR GRANULATING OF PULVERULENT AND PLASTIC MATERIALS OF ALL KINDS

Filed Aug. 8, 1935

Serial No. 35,394

2 Sheets-Sheet 1



INVENTORS:
JOSEPH EIRICH & LUDWIG EIRICH, DECEASED
GUSTAV EIRICH.
LUDWIG EIRICH.
WALBURGA EIRICH.
MARIA HOLLERBACH, NEE EIRICH,
ROSA EIRICH.
JOHANNA EIRICH
& ANNA EIRICH
HEIRS AT LAW OF LUDWIG EIRICH, DECEASED

BY Bailey & Larson
ATTORNEYS

PUBLISHED
JUNE 15, 1943.
BY A. P. C.

J. EIRICH ET AL
METHOD OF MIXING OR GRANULATING
OF PULVERULENT AND PLASTIC
MATERIALS OF ALL KINDS
Filed Aug. 8, 1935

Serial No.
35,394
2 Sheets-Sheet 2

Fig. 11.

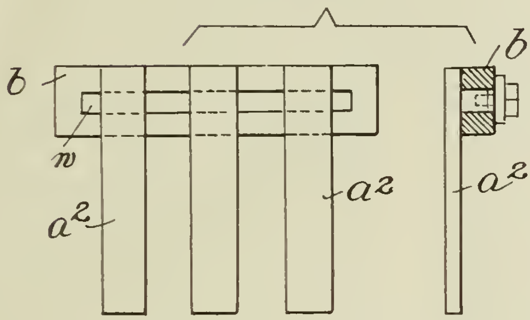


Fig. 12.

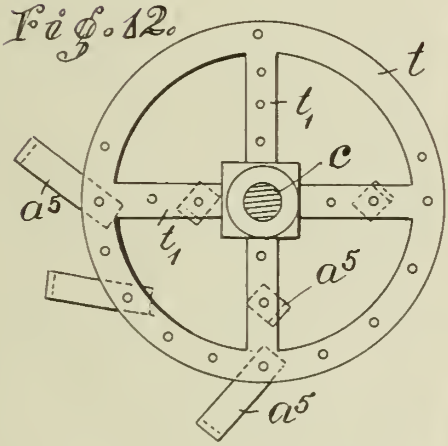
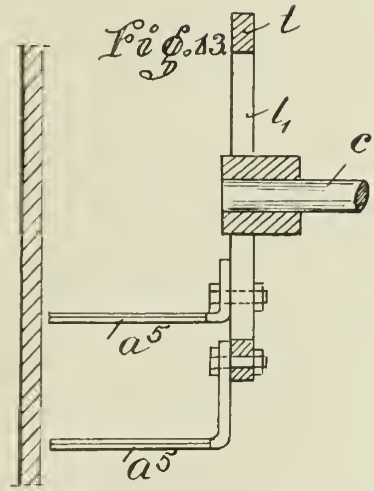


Fig. 13.



INVENTORS:
JOSEPH EIRICH &
LUDWIG EIRICH, DECEASED
GUSTAV EIRICH,
LUDWIG EIRICH,
WALBURGA EIRICH,
MARIA HOLLERBACH, NEE EIRICH,
ROSA EIRICH,
JOHANNA EIRICH
& ANNA EIRICH
HEIRS AT LAW OF LUDWIG EIRICH, DECEASED
BY Bailey & Larson
ATTORNEYS.

Published June 15, 1943 Serial No. 92,371

ALIEN PROPERTY CUSTODIAN

MANUFACTURE OF MATERIALS COMPRISING ARTIFICIAL RESINS

Paul Vögele, Berlin-Dahlem, Germany; vested in the Alien Property Custodian

No Drawing. Application filed July 24, 1936

For various purposes the problem exists in the art to work up artificial resins and similar bodies in a dispersed form. Hitherto in principle the path followed has always been to disperse more or less initially condensed resins, that is to say, to dissolve, to emulsify or to suspend the same.

According to the present invention on the other hand the substances causing the resin formation are dispersed individually and the condensation first carried out in the additive system, that is to say, in the simultaneous presence of other indifferent substances taking no part in the resin formation, upon or in which the condensation or polymerization product is intended to be dispersed, without in this manner the yield being reduced to any appreciable extent from a commercial point of view by evaporation losses of one of the resin forming components.

Proposals have already been made to carry out the condensation by introduction of the individual reaction components for example into a mass of fibres, (compare German Patent No. 231,148). According to this jatent phenol and formaldehyde are employed. In this manner there occur, however, unavoidable losses of formaldehyde unless special devices are provided for the recovery of the formaldehyde evaporation losses.

Such evaporation losses are avoided according to the present new process in such a manner that according to the invention advantageously aqueous dispersions of phenol and of components produring artificial resin formation therewith, which possess a higher evaporation point than the dispersing agent, for example compounds splitting off aldehyde such as hexamethylenetetramine, are brought together in the presence of the indifferent body or body to be coated and, for example by heating, condensed and polymerized in the open atmosphere, that is to say, without recovery devices for the artificial resin components, during which suitably at the same time the dispersing agent is removed, for example gradually evaporated.

Instead of the phenols obviously also their homologues or other substances giving resin formations with aldehyde or their substituents can be employed, as for example cresols, primary amines, as for example aniline, urea, casein, glutin-containing substances such as gelatine, glue etc. Instead of the compounds splitting off aldehyde also such substituents can be employed as produce resin formation with phenol or its substituents and the evaporation point of which is so high that at the temperature necessary for the condensation no appreciable evaporation losses take place, as, for example, sulphur which with phenol gives the known phenol-sulphur resins. The compounds splitting off aldehyde can be employed in the form of their isolated previously formed compounds, as for example in the form of the previously mentioned hexamethylenetetramine, or also by combination of equivalent quantities of aldehyde and ammonia, which thereby intermediately come into applicatnon in the course of the complete working process.

It has already been known for a long time to harden phenol-aldehyde condensation products or other products condensed with phenol by additions of hexamethylenetetramine. Recently it has also been proposed for the impregnation with artificial resins of large porous bodies such as balks of timber etc. to carry out the condensation of phenol from the beginning with formaldehyde-ammonia (compare Swiss patent 141,109).

Furthermore, it has also been proposed to carry out the condensation of phenol with aldehyde-ammonia with the addition of solvents, in fact either with such solvents in which the condensation product is intermediately dissolved, that is to say organic solvents (compare British Patent 6,363/1912), or of water in such quantities that the aldehyde-ammonia and the phenol for homogeneous admixture are initially dissolved therein (compare U. S. Patent 1,187,230/1916).

None of the patents mentioned has however anything to do with the process of the present invention and they are distinguished from the latter by the two following essential features:

1. In the previous processes the condensation is carried out as an independent separate working operation.

2. The previous processes required the application of reflux devices for the evaporating solvent. According to the mentioned patents thus in the first place a non-dispersed starting material is obtained, which then in a second stage is subjected to a further working up (as coating or impregnating material in dissolved form for the manufacture of cast or pressed objects, if desired with the subsequent addition of filling materials etc.).

In contradistinction to these prior processes according to the present invention the result is attained that no essential losses arise by evaporation of the components taking part in the resin formation. In addition it is now also possible to carry out the condensation in excellent yield in any suitable dilution and distribution also in the open atmosphere, that is to say without any devices for recovery of constituents which distil off.

This result is attained on the one hand in such a manner that, as already stated, as components for artificial resin formation for example compounds splitting off aldehyde, such as formaldehyde-ammonia, hexamethylenetetramine, sulphur and the like substances are employed, which possess a higher evaporation point than the dispersing agent and thus for example at the point of evaporation of water possess a very low vapour pressure and also for example are not volatile in steam, and is attained on the other hand in such a manner that the reaction velocity of these substances with phenols and the like even at great dilutions is still sufficiently large in order to bind the phenols so rapidly that no essential losses of the latter substances by evaporation can any longer take place.

By this means therefore the hitherto customary initial condensation as an independent working operation is obviated and the condensation is only carried out and localised at the place where the finished resin is finally intended to be employed. By this means also the result is attained that the resin produced is obtained immediately and without special operations distributed in a dispersed form on or in the indifferent bodies. This is particularly valuable in such cases in which is concerned the carrying out of the condensation on a body in a thin layer, as for example in a paper or fabric web saturated with the dispersion.

In particular instances there accrues in addition the very important advantage that particular dispersions of this type, as for example formaldehyde-ammonia, can be employed in completely neutral solutions and therefore can be associated with the most varied substances, even alkali-sensitive bodies as for example wood fibres, straw fibres, cotton etc. In this case there always exists a neutral or only very weakly alkaline reaction of the system since the alkaline ammonia, which gradually becomes free as the reaction proceeds, vaporises at the temperatures necessary for the reaction to the same extent as it is produced.

By dispersion is to be understood any type of distribution, that is to say solution, emulsion or fine or coarse suspension. As dispersing agent advantageously water is employed. In this case the components taking part in the resin formation can either at the same time be distributed and employed in one and the same dispersing agent, or a dispersion of each individual component in a dispersing agent is produced, for example a suspension of phenol and a solution of hexamethylenetetramine. In this case also at the same time different liquids as for example water and alcohol can be employed. These preparations of the components can be added separately, for example pressed or sucked through the fibrous material serving as a felting skeleton or filling material, or they can be combined with loose fibrous material.

The condensation of the resin components can suitably also be caused to take place and assisted by additional treatment with chemicals as for example alkalies, catalysts and the like.

The removal at least of a part of the dispersing agent contained in the system can be carried out by pressing off, sucking off, centrifuging, cataphoresis and the like.

The surface on which the resin is intended to be condensed and retained can also be the interior of porous bodies as for example of wooden articles to be impregnated or performed fibrous bodies such as paper or fabric webs, or also the surface of individual loose fibres which are mixed with the dispersion of the binding agent components directly in the loose condition and subsequently, according to the fibres employed, simultaneously felted, freed from the liquid and hardened.

With quite particular advantage the working method of the invention can finally be employed in conjunction with the process of ——— to which masses similar to wood are produced in such a manner that feltable fibrous substances are felted and before, during or after the felting treated with preparations of binding agents capable of being hardened later, whereupon the excess liquid is removed and the fibrous mass suitably at the same time shaped in a manner which does not entirely remove the porosity and, likewise with retention of the porosity, dried at ordinary or elevated temperature with hardening of the binding agent.

The following examples illustrate the invention.

Example 1

To 900 parts of water are added about 50 parts of about 40% formalin solution and also about 30 parts of 25% ammonia. This solution is then suitably neutralised for example with a little aluminium sulphate or the like. Into this solution are introduced 10 parts of dry mechanical wood pulp or cellulose. This material is well suspended and finally after the addition of about 5 parts of cresol the whole stirred until the cresol is completely distributed in the mass. Then the mixture is formed into webs for example on a paper machine. The remaining solution is then together with the paper web heated to about 80–100° C. and slowly dried. In this condition a condensation has already taken place. Subsequently any suitable further treatment can take place, for example the final hardening produced in hot presses.

Example 2

Dry paper sheets or fabric webs are immersed in a solution of 30 parts of hexamethylenetetramine, 100 parts of phenol and 900 parts of water. The saturated sheets or webs are then heated to 80–90° C. and slowly dried. For hardening of the resin they are then individually, or pressed several on top of one another, maintained for some time at a temperature of 120–140° C.

Example 3

In the same solution as in Example 2 are immersed well dried and if desired evacuated wooden objects, for example planks, balks, etc. until the solution has penetrated well. These wooden objects are then likewise first heated to 80–90° C. slowly dried and hardened at 120–140° C. The penetration of the impregnation solution into the wood can in this case likewise be facilitated by a slight excess of ammonia.

Example 4

Porous shaped bodies of asbestos fibres, slag wool or the like are immersed in the following liquid; 100 parts of crude cresol dissolved in 900 parts of water with the addition of the necessary quantity of caustic soda lye, contain 40–50 parts of finely divided sulphur. The saturated shaped bodies are heated to 80–90° C. and slowly dried, thereupon the heating is continued at 120–140° C., if desired with repeated drying and pressing until the hardening is sufficient.

PAUL VÖGELE.

Published June 15, 1943 Serial No. 106,014

ALIEN PROPERTY CUSTODIAN

STIFFENERS FOR ARTICLES OF APPAREL

Willy Stelkens, Köln-Marienburg, Germany; vested in the Alien Property Custodian

No Drawing. Application filed October 16, 1936

My invention relates to means for stiffening linen and other garments and underwear including shirts, cuffs, collars, caps and the like and it is an object of my invention to provide stiffening means which, while being as efficient as similar means hitherto in use, can be produced and marketed at lower prices.

Hitherto, in order to stiffen linen and other articles of the kind mentioned above, stiffeners made of Celluloid have been used. These stiffeners however involve the disadvantage of rendering the garments impervious for moisture and air. In order to avoid this drawback, the stiffening inserts have been formed with perforations, however, since these perforations showed on the surface of the finished article, such perforated stiffeners have not come into extended use.

Recently fabrics consisting of cotton threads in combination with threads made from cellulose derivatives soluble in organic solvents have been suggested for the same purpose. By moistening such fabrics with a solvent for the cellulose derivatives these latter can be rendered sticky and the fabric can thus be fixed between two layers of the fabric to be stiffened. In this case the stiffened articles may remain pervious to air and moisture, however the mixed fabrics constituting the stiffener proper command a high price and can therefore be used only in combination with the more expensive kind of articles.

My invention is designed to substitute for these unduly expensive stiffeners a stiffening means and adhesive, which, while lending itself to an as simple use as the mixed fabric mentioned above, forms an equally efficient stiffener and does not in any way impair the permeability of the linen goods or the like for air or moisture, while being at the same time far cheaper in production.

The stiffeners according to my invention possess the character of paper-like felted products formed preferably from mixtures of inert fibres and waterproof materials preferably in fibrous form which, when acted upon by an organic solvent or swelling agent, assume the character of an agglutinant, such as the well known cellulose derivatives the kind and proportion of these agglutinant materials being so chosen that, when the paper-like stiffeners are treated with suitable solvents or swelling agents, the agglutinant materials will become sticky and will be suitable for permanently stiffening and gluing together other layers of fabric, while being kept porous owing to their contents of inert materials, i. e. materials which are not affected by the solvent or swelling agent.

These conditions can be fulfilled in the first place by suitably choosing the proportion between the inert fibres and the softening or soluble cellulose fibres. The strength and dimensions of the fibres and other particles of the components may also be of importance. By suitably tuning the solvents or softeners in accordance with the composition of the agglutinants and by suitably choosing the mode of manufacture of the final product, the period of time during which the solvents or softeners act on the stiffener, the temperature etc. I may provide that between those places, where the stiffener glues the layers of other fabric together, portions pervious to air and moisture are provided. The irregularity, resulting from the manner in which the stiffeners are manufactured, in the arrangement of the sticking and the non-sticking sections of the stiffener together with the possibility of controlling the extension, which may be very small, of the sticky portions, prevent the stiffening inserts from showing on the surface of the stiffened fabric layers.

I may also deposit on the felted stiffener products according to this invention, for instance by spraying or rolling, and in a more or less regular or irregular arrangement and under the form of points, lines, patches, grids or other screen-like patterns a drying solution or paste or the like which impregnates and surrounds the fibres in the stiffener product and which is substantially not attacked by the solvents or softeners, thereby keeping the sections covered therewith porous, and this more particularly, if the matter contained in these solutions or pastes can be subsequently removed by washing or otherwise.

While as a rule the percentage of inert fibres will predominate over the agglutinant fibres in the compound stiffener, a felted product of the kind last mentioned may also consist mainly or exclusively of agglutinant fibres. The covering screens or grids formed by depositing on the fibres or fibre combinations a drying solution or paste and the like may moreover also serve to reinforce the felted product.

As inert fibres I prefer employing in the first place fibres of cellulose pulp, cotton, linen, hemp, nettle and the like, while the agglutinant fibres may be formed from cellulose derivatives such as cellulose acetates and, in view of a better suitability for ironing and superior waterproofness, cellulse triacetate, however also from mixed cellulose esters, cellulose ethers and the like or

resins and more especialy artificial resins such as polyvinyl acetate and the like. The covering solutions or pastes forming screens, lines, points, etc. may for instance consist of substances, such as water soluble starch, gum arabic and the like, which are not soluble in the solvents for the cellulose agglutinants. The agglutinants are preferably used in fibre form, but may also be granular or pulverulent. In the preparation of the stiffeners and agglutinants I may also use foreign adhesive substances and fillers, i. e. substances and fillers, which are insoluble in the organic solvents used.

I may further improve the stiffening and adhesive means according to this invention by incorporating therein a light weight preferably wide meshed fabric. Fabrics of this kind are inexpensive and do not materially increase the thickness of the stiffener, but impart strength to the felted product and may thus greatly improve the suitability thereof for application to the articles to be stiffened. These fabrics may be incorporated in the still moist felted product directly after part of the mixture of fibres constituting same has been deposited on the wire or in any other manner known in the art of paper making. I may also glue such wide meshed light weight fabric on or into the felted products, using for this purpose special agglutinants or, alternatively, the adhesive matter forming part of the felted mixture, which may be superficially softened, care being taken to retain the porosity of the product. This preservation of the porosity may for instance be provided for by keeping the quantity of solvent or the quantity of agglutinant material as small as possible. Alternatively I may use a solvent capable of dissolving only part of the agglutinant matter contained in the material to be felted together, or the solvent effect may be lowered by the addition of a non-solvent.

I may unite such a wide meshed fabric with the felted products in a particularly satisfactory manner and without using any kind of agglutinant therefor by so choosing the width of mesh of the light weight fabric and the kind or length of the inert and the agglutant fibres in the stiffening felt, that the fibres become felted together across the meshes of the light weight fabric, when the mixture is felted on the paper making machine. I may promote this felting together of the fibres by setting the wire of the paper machine vibrating. Also in this case and more especially if fabrics are used, which readily absorb the solvents and solutions, the amount of the inert fibres in the felted products may be reduced or their incorporation may even be dispensed with altogether.

In incorporating the stiffening and adhesive means according to my invention in shirt collars, cuffs, uniform collars, caps and the like I may for instance place the paper-like felted mixture of fibres between the fabric layers to be united and stiffened, slightly fixing it in place between these layers by superficial sewing, stitching or glueing, spreading on the fabric a solvent or swelling agent for agglutinant fibres with a brush or by spraying or causing the agglutinant fibres to swell by acting thereon with a solvent in the vapor phase, whereupon the compound product is subjected to the action of pressure and, if necessary, heat to firmly unite the constituents. If desired, the stiffening material may also be prepared for the stiffening and glueing by immersing it in a suitable solvent and then placing it between the fabric layers to be united. Before applying pressure etc. care must of course be taken to not destroy the porsity provided by the particular structure of the stiffener and agglutinant mixture, when uniting same with the fabric, for instance by displacing the softened layers under pressure.

In special cases the stiffeners and agglutinants according to this invention may also be combined one-sidedly with a single fabric layer.

In practicing my invention I may for instance proceed as follows:

Example 1

100 kgs. fibriform cellulose acetate and 150 kgs cellulose are ground separately in the rag engine and the ground materials are then mixed, whereupon the ground mixture is treated in accordance with the paper making process for the production of thin paper-like fleeces weighing about 100 grs per m^2. These fleeces are combined with linen and other wearing apparel for instance by acting thereon with acetone, if cellulose diacetate fibres are present therein, or with a mixture of nine parts by volume methylene chloride and one part alcohol, if cellulose triacetate fibres are present.

Example 2

100 kgs fibriform cellulose diacetate and 50 kgs cellulose are treated as described with reference to Example 1 to produce a paper-like fleece. On this fleece is deposited by means of a fluted pressure roll a small quantity of a solution of 10 parts cellulose tribenzoate in 90 parts toluene. After the toluene has evaporated, the paper-like fleece is impregnated in screen form with the cellulose tribenzoate. Since this latter substance swells only very little in the acetone serving to glue the fleece together with the fabric, the parts impregnated with the tribenzoate are substantially not attacked by the acetone so that in these places no glueing together is effected and the finished fabric remains pervious to air and moisture in these places.

A similar action is obtained in a still more advantageous manner if, after the combined article has been finished, the impregnating matter is subsequently removed again, for instance by acting on the fabric with toluene. This can be effected in the simplest manner if water soluble substances, which can subsequently be washed out with water, are used in the production of the covering screens.

Example 3

Mixed artificial silk wastes, for instance mixtures of cellulose acetate and viscose, in which the latter slightly predominates, are bleached and comminuted in the rag engine to the extent of rendering the ground material suitable for the production of paper-like webs. While depositing the diluted paper pulp on the paper machine wire, a wide mesh gauze fabric is carried in contact therewith and the wire is set vibrating. By suitably choosing the width of the meshes of the gauze fabric with regard to the length of the fibres in the fibre mixture a solid felting of the fibres across the fabric will take place. Products made in this manner have been found to possess a particularly great strength.

Example 4

Cellulose acetate silk wastes are treated for the production of a paper pulp in the manner de-

scribed with reference to the preceding examples. In the ground fibrous material is embedded a cotton fabric formed with about 100 to 200 meshes per cm^2, weighing about 50 to 60 $grams/m^2$, the whole being felted together in such manner that the total weight of the combined product amounts to about 100 to 200 $grams/m^2$.

Various changes may be made in the details disclosed in the foregoing specification without departing from the invention or sacrificing the advantages thereof.

WILLY STELKENS.

Published June 15, 1943 Serial No. 129,813

ALIEN PROPERTY CUSTODIAN

PRODUCTION OF SULPHONATION PRODUCTS

Bruno V. Reibnitz, Mannheim, Germany; vested in the Alien Property Custodian

No Drawing. Application filed March 9, 1937

The present invention relates to the production of sulphonation products.

In U. S. Patent No. 1,993,375 there is described a process for the production and purification of sulphonation products by causing sulphonating agents to act on high molecular alcohols, neutralizing the resulting products and mixing with water, incorporating the aqueous mixture with a water-soluble solvent and subjecting the resulting mixture to a treatment with a water-insoluble solvent, selected from the class consisting of liquid hydrocarbons and chlorinated hydrocarbons, thereby freeing the neutralized products not reacted with and not capable of reacting with sulphonating agents.

I have now found that highly valuable sulphonation products from mixtures containing alcohols of high molecular weight and other organic substances may also be obtained by at first converting the etherifiable constituents contained in the said mixtures into the corresponding polyalkylene glycol ethers, then treating the mixture with sulphonating agents and after neutralizing extracting the mixture in the presence of water with hydrocarbons or chlorinated hydrocarbons of low boiling point while adding low-molecular alcohols or ketones.

As mixtures suitable for the present process, i. e. those containing alcohols of high molecular weight and other organic substances, such as fatty acids, hydroxy acids, esters, aldehydes, ketones and the like, I may mention for example the alcohol mixtures, resulting in the reduction of fatty acids having a high molecular weight or their esters, as for example palmitic acid, stearic acid, oleic acid, ricinoleic acid, palm kernel oil, castor oil, tallow, sperm oil or other oils, fats or waxes. The said reduction products contain besides the mentioned esterifiable constituents generally esterlike waxes. Furthermore may be mentioned as suitable mixtures the oxidation products of paraffinic hydrocarbons, from which may or may not be removed the acid or the saponifiable constituents.

The introduction of the polyalkylene glycol radicles into the etherifiable constituents of the mixtures is effected in known manner for example by treating with alkylene oxides, preferably with ethylene oxide. It is also possible to introduce into the alcohols or carboxylic acids polyalkylene glycol ether radicles as such, as for example by condensing with polyglycol ethers having reactive atoms or atomic groups, such as beta-chlor-beta'-hydroxydiethylene ether. Thus polyalkylene glycol ether radicles of the general formula $—(O—R)_n—OH$, wherein R stands for an alkylene radicle, such as ethylene, propylene, or a butylene radicle and n is a whole number. For example by causing ethylene oxide to act on the said mixtures polyglycol ether radicles containing 1, 2, 5, 10 or more $(O—C_2H_4)$—groups may be introduced into the etherifiable compounds contained in the said mixtures. The mixture containing the polyalkylene glycol ethers formed is sulphonated in any desired manner.

The process is carried out for example as follows:

Mixtures containing alcohols of high molecular weight and other not etherifiable substances are treated with alkylene oxide in such an amount that polyalkylene glycol ether radicles of any desired molecular size enter into the molecules of the alcohols or the acids. The ether like compounds are then sulphonated and the resulting sulphonation mixture is neutralized by means of aqueous alkaline liquors. To the neutralized mixture there is added an alcohol of low molecular weight, as for example methyl alcohol or isopropyl alcohol, and then an aliphatic hydrocarbon, as for example benzine. After thoroughly mixing and standing for some time, layers are formed which are then separated from each other. The proportion of low molecular aliphatic alcohols to benzine hydrocarbons may be varied within certain limits, depending on the material to be treated and its content of water; it amounts to from about 1:1 to 2:4. The extraction may be repeated several times with somewhat the same amount of the hydrocarbon. The addition of the aforesaid solvents is made at room temperature or slightly elevated temperature, preferably between 20° and 50° C. The aqueous layer obtained is then freed from water and the alcohol by evaporation. From the distillate the alcohol may be recovered. Thus a sulphonation product remains which contains no or practically negligible amounts of undesirable by-products.

The following examples will further illustrate how the present invention may be carried out in practice, but the invention is not restricted to the said examples; the parts are by weight.

Example 1

The oxidation product obtainable according to German Patent No. 405,850 from paraffin-like middle oil with the boiling ranges between 260° and 320° C, is hydrogenated by means of hydrogen at 220° C under a pressure at 200 atmospheres in the presence of a copper-magnesium catalyst. 100 parts of the hydrogenation product

having a hydroxyl number of 160 and consisting chiefly of aliphatic alcohols having a high molecular weight, after an addition of 0.5 part of sodium hydroxide, are reacted with 37.5 parts of ethylene oxide at 140° C. The condensation product of ethylene oxide thus obtained is sulphonated at about 20° C with such an amount of chlorsulphonic acid as is theoretically necessary, the said amount being calculated with reference to the hydroxyl number. The sulphonation mixture is then neutralized with 10 per cent aqueous caustic soda solution until the reaction has turned alkaline (determined with phenolphthalein). The solution is then extracted at 35° C by the addition of 150 parts of isopropyl alcohol and 150 parts of benzine. After separating the layers formed the aqueous layer is evaporated. The residue consists of about 80 parts of a high-grade sulphonation product having a good washing power which gives no undesired precipitates when employed in water containing lime.

Example 2

A product obtained by oxidizing paraffin wax with air is hydrogenated, after removing the saponifiable constituents by the treatment with caustic soda solution and, after freeing it from any unattacked initial material, by extracting with methanol, and then subjected to distillation in vacuo. One half of the distillation product, having a hydroxyl number of 210, is then treated with so much ethylene oxide at 150° C, after adding 0.5 per cent of sodium ethylate, that the ethylene oxide absorbed amounts to about 3 molecular proportions for each hydroxyl group. The resulting product is then dissolved in benzine and then sulphonated at 15° C by treatment with a mixture of equal parts of ether and chlorsulphonic acid. The sulphonation mixture is then neutralized by means of 20 per cent. caustic soda solution while well cooling, 100 parts of 50 per cent ethyl alcohol are then added whereupon the solution is thrice extracted at 45° C each time by means of 150 parts of benzine. By evaporating the aqueous alcoholic solution there are obtained about 120 parts of a sulphonation product containing about 15 per cent of inorganic salts, the said product having a good washing power, especially for linen, as well as an excellent dispersing power for lime soaps.

Example 3

A product obtained from paraffin wax by oxidation with air, having an acid number of 50 and a hydroxyl number of 36, is distilled in vacuo until 50 per cent of the product are distilled off. 15 parts of ethylene oxide are then caused to act on 100 parts of the distillation residue after addition of 1 part of sodium ethylate. The reaction product is dissolved in benzine and then treated at 50° C with chlorsulphonic acid in an amount as theoretically required (calculated on the hydroxyl number). After neutralizing the sulphonation product with 10 per cent caustic soda solution, 50 per cent ethyl alcohol are added in an amount corresponding to the caustic soda solution added. The solution is then extracted at from 40° to 50° C three times with 200 parts of benzine each time. The aqueous alcoholic solution obtained is evaporated to dryness, thus 140 parts of a sulphonation product being obtained which has an excellent foaming, washing and dispersing power and which is especially suitable for dispersing calcium soaps.

BRUNO v. REIBNITZ.

Published June 15, 1943 Serial No. 108,196

ALIEN PROPERTY CUSTODIAN

PRODUCTION OF ACETALDEHYDE

Friedrich Lieseberg, Ludwigshafen-on-Rhine, and Gustav Wietzel, Mannheim, Germany; vested in the Alien Property Custodian

No Drawing. Application filed October 29, 1936

The present invention relates to an improved process for producing acetaldehyde from gases containing acetylene.

It has already been proposed to convert concentrated acetylene into acetaldehyde by treating it with solutions of iron sulphate in sulphuric acid, the said solutions containing mercury. The acetylene used in excess is led in circulation. The iron salt solution, which contains the major portion of the iron in the ferric stage at the commencement of the reaction, is reduced to the ferrous stage during the formation of the acetaldehyde. The continuous preparation of acetaldehyde is carried out by adding to the iron salt solution in a given time only such an amount of iron in the ferric stage as is reduced in the same time. Generally speaking the procedure is such that with the progressive addition of ferric sulphate solution and the continuous withdrawal of exhausted solution, only very little ferric sulphate is present in the solution because the amount of ferric sulphate added in the unit of time is immediately converted into ferrous sulphate.

In the case of gases having a comparatively low content of acetylene (up to about 20 per cent by volume), such as have been produced recently in electric arc plants, acetaldehyde can only be obtained in moderate yields with the iron salt solutions described above. Strongly diluted acetylene mainly passes unchanged through the iron salt solution and is thus lost as far as conversion into acetaldehyde is concerned. It is necessary, however, since the gas containing acetylene cannot be led in circulation without difficulty by reason of its strong dilution, to convert the acetylene as completely as possible into acetaldehyde by a single passage through the iron salt solution, because otherwise the process is useless from an economic point of view.

In the copending application Ser. No. 83,069, filed June 2nd, 1936, one of the present inventors has described an improved process for the manufacture of acetaldehyde from gases containing up to about 20 per cent of acetylene by means of an acid solution containing mercury according to which process the gas to be treated is led through the reaction vessel in the same direction as the catalytic liquid itself, the latter being led in a cycle at the same time and preferably so that a multiple of the amount of liquid present in the reaction vessel is circulated per hour. In the example of the said co-pending application Ser. No. 83,069 the catalytic liquid comprises a certain amount of iron in the form of ferrous and ferric sulphate.

We have now found that gases of the said kind containing acetylene in an amount of up to about 20 per cent by volume can be worked up with special advantage into acetaldehyde when the ratio of ferric sulphate to ferrous sulphate in the iron salt solution is not allowed to fall below a certain limit. Care should be taken that more than about 20 per cent of the total amount of iron is always present in the ferric stage. For example it is advantageous to use a solution which contains between 25 and 100 grams of iron per liter, about 30 per cent being in the form of ferric sulphate and the remainder in the form of ferrous sulphate. Depending on the nature of the gases containing acetylene employed, the content of other unsaturated hydrocarbons of which varies according to the hydrocarbon mixture serving for the preparation of the acetylene, it may be necessary to vary the said ratio of the ferric stage to the ferrous stage, i. e. to increase or decrease the proportion of ferric sulphate in the solution. In this manner it is easy to adapt the degree of efficiency of the solution to the gas mixture to be worked up. A higher content of unsaturated hydrocarbons in the initial gas necessitates a higher proportion of ferric sulphate. In this way the conversion of acetylene into acetaldehyde is rendered as complete as possible and at the same time too high a content of ferric sulphate in the solution, which may give rise to undesirable side reactions, is avoided.

The procedure may be for example that the reduction of the iron salt at first only present in the ferric stage taking place during the addition of water to the acetylene is allowed to proceed until the desired proportion of ferric sulphate to ferrous sulphate has been set up. There is then continuously added to the iron salt solution such an amount of ferric sulphate solution that the ferric sulphate content does not fall below the desired limit of 20 per cent. Naturally a corresponding amount of the reduced solution must be always withdrawn in order to maintain unchanged the effective amount of iron of for example 35 grams per liter and the volume of the salt solution. Atmospheric or also increased pressures may be employed.

When the ratio of ferric sulphate to ferrous sulphate does not fall below the above-specified limit, there is not only the advantage that for the first time the economic working up of gas mixtures containing acetylene is rendered possible but there is the further advantage that me-

tallic materials without protective coverings, as for example rubber, may be used for the construction of the parts of the vessels which come into contact with the hot sulphuric acid iron salt solutions. There are then suitable as constructional materials nickel chromium steels which may be welded at any time when it is necessary, this being impossible with parts of vessels which are coated with rubber or lined with brickwork. Indirect transfer of heat for the heating or cooling of the salt solution may also be carried out without difficulty. Furthermore parts coated with rubber may be replaced by parts of the said materials in cases where rubber-covered walls might be rubbed through, as for example in towers which are charged with filler bodies.

The following example, given with reference to the accompanying drawing which shows diagrammatically an arrangement of apparatus according to this invention, will further illustrate the nature of this invention but the invention is restricted neither to this example nor to the specific arrangement shown.

Example

150 liters of a solution which contains 24.5 grams of iron in the form of ferrous sulphate and 10.5 grams of iron in the form of ferric sulphate per liter and also contains 3 per cent of free sulphuric acid are charged into the vessel A. Into this solution there are blown through the pipe G 11 cubic meters per hour of a gas containing acetylene which in addition to hydrogen and methane and propane contains 13 per cent by volume of acetylene and 1.45 per cent by volume of other unsaturated hydrocarbons. The gas containing acetylene moves in the same direction as the salt solution. The solution itself is led in circulation over metallic mercury situated in the container B and/or in the parts of the tower A and/or C in such manner that by the circulation the volume of the said solution contained in the tower A is renewed several times per hour whereby the salt solution always remains saturated with mercurous and mercuric sulphate. The escaping gas which leaves the tower is under an excess pressure of one atmosphere. In order to maintain the composition of the salt solution, an amount of the solution corresponding to the amount of ferrous sulphate formed is withdrawn through the pipe D, the ferrous sulphate is converted in the vessel E into ferric sulphate and returned through the pipe F. A 94 per cent conversion of the acetylene is thus obtained. If, on the other hand, the amount of ferric sulphate in relation to the amount of ferrous sulphate is allowed to fall below 20 per cent of the total amount of iron, the conversion of acetylene continually diminishes and a yield of scarcely 70 per cent is attained. By increasing the ferric sulphate content to the former value (30 per cent of the total iron), the high conversion value of 94 per cent may be immediately obtained again. The residual gas together with the acetaldehyde formed and the water vapor carried along with it leave the vessel A through the pipe H. The acetaldehyde may be readily separated from the gas mixture by cooling and washing with water.

FRIEDRICH LIESEBERG.
GUSTAV WIETZEL.

Published June 15, 1943 Serial No. 132,770

ALIEN PROPERTY CUSTODIAN

PRODUCTION OF FATTY ALCOHOL SULFONATES

Winfrid Hentrich, Duesseldorf-Reisholz, Carl Albert Lainau, Duesseldorf, and Wilhelm Jakob Kaiser, Duesseldorf-Benrath, Germany; vested in the Alien Property Custodian

No Drawing. Application filed March 24, 1937

This invention relates to the production of fatty alcohol sulfonates from mixtures of higher aliphatic hydrocarbons having about 8 or more carbon atoms in the molecule.

The principal object of the invention is to provide a new manner of utilizing substantially valueless higher aliphatic hydrocarbon mixtures of the kind that accrue in the synthetic preparation of benzine and to obtain valuable wetting, washing, cleaning, emulsifying and dispersing agents therefrom.

It is therefore a further object of the invention to provide a new process by which valuable fatty alcohol sulfonates may be prepared from by-product raw materials instead of the costly naturally occurring fatty acids and esters which have heretofore been used as raw materials in the manufacture of these sulfonates, and which usually must be imported.

We have found that the liquid-solid mixture of higher aliphatic hydrocarbons, consisting for the most part of compounds having from 8 to 18 carbon atoms in the molecule, which is obtained in the synthesis of benzine from carbon monoxide and hydrogen according to the process of Fr. Fischer (see Brennstoff-Chemie (1928), page 21; idem (1932), page 461 et seq) may be used as raw material for the production of fatty alcohol sulfonates. The physical properties of mixtures of this sort are such that they are not suitable for industrial uses. They are too viscous for use as lubricants, and their boiling point is too high for use as fuel in internal combustion engines. As a result they have heretofore been considered waste products. In accordance with our process, however, these mixtures are converted into fatty alcohol sulfonates and in this form they find uses in many technical fields, particularly the textile industry, as wetting, washing, cleaning, emulsifying and dispersing agents.

In general the process of our invention involves the production of a mixture of higher molecular hydrocarbons by reacting carbon monoxide and hydrogen in a manner which is the same or similar to the process of Fischer for the synthetic production of benzine, oxidizing a liquid-solid mixture of hydrocarbons having 8 or more carbon atoms obtained by this reaction to produce primarily acid oxidation products, reducing the said oxidation products to form a mixture of higher molecular alcohols and then sulfonating the mixture of higher molecular alcohols to obtain the desired fatty alcohol sulfonates. If desired the oxidation products obtained in the second of these operations may be esterified with mono or polyvalent alcohols before the reduction reaction takes place. The sulfonation products obtained from the sulfonation reaction are usually neutralized before put to practical use.

Satisfactory conditions and proecdure for preparing the mixture of higher molecular hydrocarbons are disclosed in the publication of Fischer referred to above. The oxidation of a mixture of this character is carried out in any of the several manners known to the art, and by the oxidation treatment the hydrocarbons are changed into reaction products consisting for the most part of acids and their derivatives such as esters and lactones, which products are herein referred to collectively as "oxidation products." If desired the mixture of hydrocarbons may be treated to separate the lower molecular hydrocarbons having 6 or less carbon atoms in the molecule before being subjected to the oxidation treatment.

Suitable oxidation treatments involve reacting the liquid-solid mixture with oxygen, an oxygen containing gas, such as air, or with compounds that liberate oxygen, such as ozone, nitric oxides, nitric acid or chromium acid. The treatment may be effected either in the presence or in the absence of oxidation catalysts such as the heavy metals and salts of heavy metals for example, manganese, nickel, cobalt, copper, lead and vanadium, or alkalis, alkaline earths or their salts. These catalytic metals may be employed in the form of their fatty acid derivatives or soaps as may be produced by neutralizing saturated or unsaturated fatty acids, naphthenic acids and resinic acids, which compounds form colloidal solutions with the hydrocarbon mixture undergoing treatment.

Before the reduction step of the process is carried out, it is desirable but not necessary to subject the oxidation products to a distillation, cooling, selective solvent or other treatment, whereby the alcohols or other unoxidized portions of the oxidation products are separated from the oxidized portions. Furthermore the oxidation products may be separated from each other if it is desired to treat any particular fraction in a more concentrated form.

The oxidation products may be reduced by processes already known to the art. The reduction of the acids may be accomplished most satisfactorily by treatment at elevated temperatures and pressures in the presence of hydrogen and a hydrogenation catalyst. Temperatures of from about 200 to 350° C. and pressures of from 50 to 300 atmospheres are suitable. Suitable hydro-

genation catalysts include nickel, copper, cobalt, chromium, mixed catalysts prepared from these metals, or noble metals. Instead of a hydrogenation treatment the oxidation products may be reduced according to other known methods, for example, in the treatment of ester components of such products it may be preferable to proceed according to the process of Bouveault and Blanc in which the reduction is effected by the action of an alkali metal, particularly sodium, in the presence of ethyl or other low molecular alcohols.

After a mixture of higher molecular alcohols has been obtained in accordance with one of the procedures above described, this mixture is sulfonated by treatment with known sulfonating agents, such as concentrated sulfuric acid, fuming sulfuric acid, or chlorsulfonic acid. The sulfonating reaction takes place more readily in the presence of solvents such as ether or dibutyl ether, benzine hydrocarbons, chlorhydrocarbons and the like, addition compounds of chlorsulfonic acid, sulfonated ether, ester or tertiary amine, such as pyridine. If necessary the sulfonation step can also be carried out in the presence of a water absorbing agent.

After sulfonation, the sulfonated product may be neutralized with alkaline agents, for example, alkaline lys, alkali carbonates and ammonical or organic bases.

Illustrative details of several modes of practicing the invention are set forth in the following examples.

Example I

A mixture of higher hydrocarbons obtained in the synthesis of benzine by the process of Fischer is oxidized by blowing it with air in the presence of a manganese soap at a temperature of 100 to 150° C. The oxidation product, after separation of most of the unsaponifiable material, is converted into a mixture of fatty alcohols by treating it with hydrogen at elevated temperatures and pressures.

One hundred and thirteen parts by weight of these fatty alcohols (boiling point, at 12 mm., 110 to 270° C. and hydroxyl number, 248) are treated with 20 parts by weight of pyridine. The resulting mixture is then added to a mixture of 100 parts by weight of pyridine and 67 parts by weight of chlorsulfonic acid, while stirring and cooling. The temperature is kept at 40° C. After neutralization with sodium hydroxide, removal of pyridine by distillation and drying, a fatty alcohol sulfonate mixture is obtained in the form of a colorless powder that dissolves entirely in water. Solutions of this powder have very good foaming and wetting properties.

Example II

One hundred and twenty-five parts by weight of a fatty alcohol mixture obtained in the same manner as described in Example I, having a hydroxyl number of 225, are dissolved in 125 parts by weight of ether and slowly treated by 67 parts by weight of chlorsulfonic acid while being stirred and cooled. During this treatment the temperature is not allowed to exceed 20° C. After neutralizing with sodium hydroxide the aqueous solution is spray dried. A white powder having all the properties of known fatty alcohol sulfonates is obtained.

Example III

According to this example, a fatty alcohol mixture is obtained, as in the preceding examples, by reducing an oxidation product of higher aliphatic hydrocarbons produced in the synthesis of benzine from carbon monoxide and hydrogen. The mixture has a boiling point of 90° C. at 14 mm., a boiling point of 288° C. at 3 mm., and its hydroxyl number is 260. 107 parts by weight of this mixture are sulfonated by the use of 67 parts by weight of chlorsulfonic acid in the same manner as described in Example II. The sulfonation product is neutralized and then spray dried, and a fatty alcohol sulfonate mixture is obtained which has the same properties as a fatty alcohol sulfonate mixture obtained from cocoanut oil.

The improved process for producing fatty alcohol sulfonates possesses certain outstanding advantages over processes heretofore employed. The reduction step of the process is extremely simple and proceeds very smoothly since it does not require special precautionary measures due to the fact that the oxidation products are free from catalytic poisons such as sulfur. The mixtures of fatty alcohol sulfonates produced by the process are very similar to the usual fatty alcohol sulfonates which have heretofore been prepared from imported natural fats and waxes. Since the raw materials for the improved process are obtainable in the form of substantially valueless by-products of domestic manufacture, the invention makes available an independent source of raw material at little expense. The products of the process may be used in the same manner as equivalent fatty alcohol sulfonates obtained from different raw materials, for example, as wetting, washing, cleaning, emulsifying and dispersing agents in the textile, leather, paper and other industries.

WINFRID HENTRICH.
CARL ALBERT LAINAU.
WILHELM JAKOB KAISER.

Published June 15, 1943 Serial No. 137,892

ALIEN PROPERTY CUSTODIAN

PRODUCTION OF METALLIC SURFACE LAYERS

Max Auwärter, Hanau on the Main, Germany; vested in the Alien Property Custodian

No Drawing. Application filed April 19, 1937

The present invention relates to the production of metallic surface layers.

It has been found, that extremely valuable metallic surface layers may, in a simple manner, be produced, if metals in the form of structures with great surface, for instance strips or bands which have a melting point above 600° are heated in a vacuum of at least 10^{-3} mm. Hg. and the sublimed metal is condensed upon materials arranged in the neighbourhood of these strips or bands.

According to the invention. metals in the form of strips or other structures having a melting point above 600° are heated to temperatures below the melting point for instance by direct electrical heating. The new method, therefore. does not require carriers, for instance tungsten boats or tungsten spirals, which usually are used for evaporating high melting metals. Here already the new method presents an advantage as contaminations by the substance of the carrier are excluded. The vacuum is chosen in such a manner, that sufficient atoms of the metal are present in the gas space and meet the material to be coated without on an average colliding with other atoms in the gas space. The free length of the way is then about equal to the distance between the metallic strip or band and the material. For this purpose generally a vacuum of at least 10^{-3} mm. Hg. and often even of 10^{-4} mm. Hg. and still higher is required. In this manner, melting of the metal is not required and an unobjectionable surface layer may quickly be formed upon the material at relatively low temperatures also. As compared with the hitherto known methods layers of more uniformity and purity are obtained in this manner. By arranging the surface of the material opposite a great surface of the heated metal, an extraordinary uniform distribution of the condensed metal is warranted, when using the above indicated vacuum which, for instance, is of great importance in the manufacture of mirrors and optical measuring instruments with surface layers which are partially permeable to light. Such layers cannot be obtained, if the metals are evaporated at high temperatures in tungsten boats or in tungsten spirals.

The most different kinds of materials including electrically bad conductive materials, as glass, quartz and ceramic materials, furthermore minerals, inorganic and organic substances may be coated by the new method with metals having a melting point above 600°. Before the treatment according to the invention, the surface of the material is preferably thoroughly cleansed and in particular freed from traces of grease and so on.

The most different kinds of devices may be used to carry out the new method. So for instance the small sides of rectangular strips or bands of metals, melting above 600°, may be fixed in copper jaws and directly be heated by an electric current. According to the particular requirements, the metal bands or strips may have the same dimensions as the material to be coated or they may have greater or smaller dimensions. To warrant the uniformity of the coating when using strips or bands of smaller dimensions than the surface of the material to be coated, the band or strip or the material is moved during the time the method is carried out.

The layers may be produced in different thicknesses. The new method is of extremely great value in the manufacture of the most different articles.

The new method has proved of great success in the manufacture of coatings from base metals, for instance aluminium. For the manufacture of coatings from base metals of the 7 and 8 group of the periodic system, for instance for the manufacture of coatings from manganese and nickel, the new method is of particular advantage.

Technically valuable articles are obtained by the use of the new method in connection with precious metals, for instance gold, and quite particularly in connection with platinum metals, for instance platinum, rhodium and ruthenium. By means of the new method mirrors capable of resisting atmospheric influences, surface layers partially permeable to light, and resistances and condensers adapted to be highly loaded may be produced which have surprisingly valuable qualities. With platinum metals, besides the above mentioned qualities, in particular the uniformity of the coatings, a high chemical and mechanical stability results.

Rhodium coatings obtained according to the new method are in particular characterized by a surprisingly high reflecting power and an extremely adhesive strength to the basis. It is impossible to damage the layer by means of a well sharpened pencil pressed against said layer by hand. The layer, moreover, resists the treatment with a polishing leather, with medicated cotton-wool, with brushes of badger bristles and the like. The adhesive strength of the layers may still be considerably improved by subjecting them to an after-treatment, for instance by rubbing them with a polishing leather or with medi-

cated cotton-wool soaked with a good lubricating means and the like. In this manner coatings are produced against which the point of a pair of scissors may be rubbed without damaging the surface. Whereas hitherto coatings of similar kinds could be produced only which could be cleansed by skilled persons only, surface layers may be obtained with a new method which may be cleansed by unskilled labourers with cleansing pastes, ordinary cleaning leathers, cotton cloth etc. The new method also allows the manufacture of mirrors which are far superior to mirrors made according to known methods. The mirrors are of excellent optical qualities and are simultaneously extraordinary stable against chemical and mechanical influences.

Examples

1. A rhodium sheet of a length of several centimetres and a width of several millimetres is clamped between two water-cooled copper jaws and heated by direct electrical heating to a temperature between 1400° and 1850° C. In a distance of 2–40 cm., for instance 8–10 cm., a facet glass article is fixed which according to a usual method has been perfectly freed from grease. The device is arranged in an air-tight container which is evacuated to 10^{-4} mm. Hg. An extremely uniform, adhesive surface of rhodium is obtained upon the glass which may be further fixed by polishing in the manner above described. Depending on the duration of the sublimation, this layer is partially permeable to light or forms a mirror of considerable reflecting power.

2. In the device described in Example 1, a rhodium strip of a length of 30 cm. and a width of 15 cm. is heated in a vacuum of 10^{-4} mm. Hg. to a temperature of 1500°. Opposite the strip or band a glass plate of the dimension of 35 by 35 cm. surface is fixed which is rotated during carrying out of the method. A perfectly uniform surface layer of rhodium is obtained which may be used for many purposes.

In a similar manner, a parabolic rotary body having an orifice of a diameter of 35 cm. may be coated with a perfectly uniform layer of rhodium. The surface mirror so obtained absolutely resists corrosion. The coating is equally well fixed to all points of the basis.

3. Upon thin asbestos layers of a surface of 50 by 100 cm. platinum is deposited in a vacuum of 10^{-4} mm. Hg. which is sublimed from a broad platinum band or strip heated to temperatures below the melting point. The asbestos layer provided with a uniform platinum coating is employed for the manufacture of resistances, capable of being highly loaded and used for very high currents. Such coated asbestos layers are perfectly stable against oxidation and have a constant value of resistance.

It is well known to produce surface layers by evaporating of supports. It may also be derived from physical considerations that the manner of evaporation is dependent on the specific surface of the evaporating metal.

MAX AUWÄRTER.

Published June 15, 1943 Serial No. 144,078

ALIEN PROPERTY CUSTODIAN

PROCESS OF SEPARATION BY ELECTROLYSIS OF THE ORGANIC ACIDS AND SALTS FROM ALBUMINOIDS AND THEIR ACCOMPANYING PECTIC SUBSTANCES

Umberto Busico, Lecce, Italy; vested in the Alien Property Custodian

No Drawing. Application filed May 21, 1937

The present invention regards electrolytic separation and purification of organic acids and salts from colloidal substances, for instance separation of tartaric acids and its salts from tartaric .products, citric acid from lemon juice, acetic acid from pyroligneous acid, purification of tartar from the "sablons rouges," and so forth.

It is known that in electrolysing the watery solutions of the organic acids or, more precisely, their alkaline salts, hydrogen develops at the cathode, whilst at the anode the anion is decomposed causing formation of CO_2 and a saturated or non-saturated hydrocarbon. For instance Kolbe subjecting, in the year 1848–49, to electrolysis a slightly concentrated watery solution of acetate of potassium obtained ethane:

$$\begin{matrix} H_3C.COOK \\ H_3C.COOK \end{matrix} \longrightarrow \underbrace{\begin{matrix} CH_3 \\ | \\ CH_3 \end{matrix} + 2CO_2}_{\text{Anode}} + \underset{\text{Cathode}}{2K}$$

Of course, potassium reacts with water and CO_2, forming carbonate of potassium.

By electrolysis of the dibasic acids of the succinic acid series, olefines are obtained. Thus, for instance, from the electrolysis of succinic acid ethylene is obtained:

$$C_2H_4(COOH)_2 \longrightarrow C_2H_4 + 2CO_2 + H_2$$

By electrolysis of the salts and acids of the fumaric acid series hydrocarbons of the C_nH_{2n-2} series are obtained.

Applicant has found that when the electrolysis of the alkaline salts is effected with small voltage and small current density, for instance 0,5–1 amp. for 1 dm^2 of active electrode, and eventually with porous diaphragms, for instance porcelain diaphragms interposed between anode and cathode,— the above said decompositions do not take place, but a regular separation of the anions and cathions at the electrodes are obtained, with production of high currents which may reach a value comprised between 60% and 70% and nearly integral utilization of raw materials for the obtention of useful products.

For obtaining low voltage it is necessary that the anodic liquid should be conductive, and may consist, for instance in the case of tartaric products, of solutions of sodic or, better still, potassic salts. By electrolysis neuter potassium tartrate is formed at the cathode, which is very soluble in water and has the feature of dissolving even the very calcium tartrate for the formation of mixed soluble salt, whilst at the anode tartar is precipitated, and tartrates of other metals are formed. If the cathodic and anodic liquids are filtered and again subjected to electrolysis, but put in contact with the heteronymic electrodes (and the cathodic one with other raw material) the same reaction will take place again. Thus one succeeds at low temperature between 30°C and 50°C with large hourly out-put, small water volume, small labour and good electrolytic output with complete exhaustion of raw material of its useful substances, and small cost of plant,— in obtaining products which with ordinary processes require a heavy outlay, much labor, non-continuous process and large quantity of water and fuel with less hourly output.

The reaction with tartaric process is probably:

$2KHA \rightarrow K_2A + H_2A$ (which migrates to the anode), in which

$$(A = \text{acid residue} = C_4H_4O_6)$$

at the anode:

$$K_2CO_3 + H_2A \rightarrow K_2A + H_2O + CO_2$$

and in a second time:

$$K_2A + H_2A \rightarrow 2KHA$$

And in a perfectly analogous way at the anode citrate of sodium potassium, magnesium, ecc. may be obtained.

This theoretical explanation of the experimental fact has no other than illustrative, but no limitative value.

The process also permits of obtaining mixed salts. Thus by electrolysing in the above described conditions with iron anode ferro-potassic tartrate in fine crystals is obtained.

With this process are obtained:

(1) Separation of organic acids at the anode by electric current,

(2) Separation of said acids from colloids,

(3) Production of useful substances, acids or their salts, and particularly

(4) Extraction of tartaric acid and citric acid and their salts from the raw materials, and

(5) Refining of products.

This invention has been described in one of its particular forms of realization, but it is understood that structural modifications are possible within the scope of invention.

UMBERTO BUSICO.

Published June 15, 1943

Serial No. 150,309

ALIEN PROPERTY CUSTODIAN

PROCESS OF MAKING ALUMINIUM OR ITS ALLOYS ANTI-CORROSIVE AND COLORING THE SAME

Kenzo Nagata, Naka-ku, Yokohama, Japan; vested in the Alien Property Custodian

No Drawing. Application filed June 25, 1937

It is known to cause a water-soluble dyestuff to penetrate the oxidized coating of aluminium obtained by subjecting the aluminium or its alloys used as anode to so-called electrolytic anodic treatment in an electrolytic cell containing an electrolyte and thus to be adsorbed by it and next to attach said dyestuff closely in the structure of the oxidized coating by treating the latter with vapour and thus colour the coating. However, the letters, figures, etc. painted with said water-soluble dyestuff become disfigured during the treatment of the coating and consequently do not produce desired lines distinctly. Further, when more than two colors are used, it is not only inevitable that their borders should become indistinct, but also the water-soluble dyestuff itself is weak against moisture, the sun, etc. Now, the present invention has improved the known process to obviate the above defect in coloring oxidized coating of aluminium or its alloys and relates to a process of colouring said coating suitably with one or more colours by employing a solution prepared by dissolving water-insoluble oil colours especially in a rapidly drying solvent, for example, benzol. That is to say, when the oxidized coating is coloured with the solution prepared by dissolving a water-insoluble oil color having a suitable colour in a rapidly drying (volatile) solvent, for example, benzol or alcohol, the solution is adsorbed quickly into the structure of the coating, while at the same time the solvent volatilizes and dries, so that if almost at the same time the same or other colour is applied freshly or desired letters or figures are painted with one or more colours, such colours do not mix together or spread and therefore a clear colouring may be obtained. If the thus-coloured coating is treated with superheated steam, its structure may not only be made compact, but the oil colour which has penetrated the structure and has been adsorbed by it attaches tightly to the coating, thus strengthening the latter both physically and chemically.

The following is an example of performing the present invention:

Using as anode an aluminium plate or a vessel made of an alloy containing more than 90% of aluminium, subject an aqueous solution of 2% oxalic acid to electrolytic operation for 1 to 2 hours at about 25° C. with 30-volts direct current and 100-volts alternate current. When an aqueous solution of chromic acid is employed as electrolyte, it must have the concentration about 3% at about 40° C. with 40 volts-direct current.

Paint with a writing brush or sprayer figures of one or more colours upon the surface of the vessel thus subjected to electrolytic operation, using a solution prepared by dissolving 10–20% of red, yellow, blue or black oil colour or their mixture in benzol or absolute alcohol. Then, seal the vessel up into an autoclave and treat the same for 10 to 30 minutes with 50 to 100 lbs. of superheated steam.

Examples of the dyestuffs used

Colour	Dyestuff
Red	Sudan Red G. G.
Blue	Ore Blue T. A.
Yellow	Sudan Yellow G. R.
Black	Sudan Black B.
Brown	Sudan Brown 3B.
Orange	Sudan Orange R.

KENZO NAGATA.

Published June 15, 1943 Serial No. 152,413

ALIEN PROPERTY CUSTODIAN

HEATING PROCESS

Alfred Schmid, Berlin-Dahlem, Germany; vested in the Alien Property Custodian

Application filed July 7, 1937

It is known to make safety igniting materials from so-called semi-pyrophoric metals, oxygen carriers, for example potassium chlorate, and friction-producing and binding agents. The semi-pyrophoric metals act as the initial igniting substances in these materials. This use of the semi-pyrophoric metals pre-supposes that such safety igniting materials are shaped into the form of bodies which can be rubbed on a friction surface without being destroyed by the rubbing, that is to say in addition to being coherent they must have a certain minimum hardness and, when rubbed on a specially prepared friction surface, the metal together with the oxygen carrier contained in the safety igniting material must be raised to a temperature which is equal to the ignition temperature of the semi-pyrophoric metal employed. The safety igniting material which has been ignited in this manner is then employed for setting fire to other bodies which form the actual combustible material, such as for example match sticks of wood or paper or the tobacco of cigars, cigarettes and cheroots.

As distinguished therefrom, it has now been found that semi-pyrophoric metals can be used not only as the initial igniting substance in the manner described, but they can also be used with particular advantage for the production of heat as well as in some cases for transmitting the heat-producing reaction and for causing definite reactions to take place, that is to say they can be used as the combustible materials themselves. The use of these materials in this manner differs fundamentally from their use as the initial igniting substances for safety igniting materials not only in that the semi-pyrophoric metals are themselves used in accordance with the present invention as the combustible materials but also in that the combustion process can be initiated by any suitable means, for example by ignition by means of matches, candles, Bunsen burners, quick matches or by fitting a separate ignition head which is ignited by friction. The semi-pyrophoric metals, which are thus employed alone and used as the combustible material or can be employed in conjunction with other combustible materials, can be employed in practice in any suitable form or in a state of division for example in the form of a powder, which may be loose, or as a superficial coating on carrier materials or on bodies to be heated, or they can be filled into hollow bodies, that is to say the mass containing the semi-pyrephoric metals need not be present in a form in which they can be heated by friction which was necessary when the metals were used as the aforesaid safety igniting materials.

As compared with the hitherto known methods of producing heat with the aid of oxidation processes, the process in which semi-pyrophoric metals are used in accordance with the invention has the particular advantage that practically no gases of combustion are produced by the combustible material because the semi-pyrophoric metals are converted by combustion into solid oxidation products, and the addition of oxygen carriers is not necessary as it is in the case of the above-mentioned safety ignition materials. Therefore any formation of gas which may occur owing to the presence of an oxygen carrier and which might be troublesome owing to the volume of the gas evolved or to its poisonous nature or its smell or its taste is entirely avoided.

The use of semi-pyrophoric metals as a combustible material has the further great advantage that the process of heat production can be carried out extremely slowly as a glowing or smouldering process and can be prolonged over a definite period. The speed of the glowing or smouldering process can be varied by using semi-pyrophoric metals of different reactivity. In the case of other kinds of incandescing masses it is already known to retard the speed of the smouldering process by additions which retard the reaction, for example zinc oxide, iron oxide, etc. The use of semi-pyrophoric materials has the advantage that such incandescing bodies can be omitted, so that the volume of the entire combustible mass is therefore reduced. If necessary such incandescing substances or ordinary metals, for example aluminium, magnesium and zinc which also have a regulating effect on the speed of combustion, can be added. The regulation can, however, be effected more simply by using the semi-pyrophoric metals alone, in which case owing to the omission of substances which retard combustion the volume of the combustible mass is correspondingly reduced.

The present process for the production of heat can find application in the most varied fields.

One important application is, for example, the productien of heat for the purpose of evolving useful gases vapours, mists, and the like by the vapourisation or thermal decomposition of substances which evolve gases and the like. In this case the semi-pyrophoric metals with or without any of the above-mentioned additions are burned together with substances, such as for example musk, resins, zinc chloride, balsams, iodine, iodine compounds and the like, which are able at

an elevated temperature to develop useful gases, vapours, mists, and the like.

For therapeutic, disinfecting vermin exterminating, odour eliminating and like purposes, it is unknown to develop smoke, gases, vapours, mists, fumes and the like by making mixtures or bodies composed of substances which develop the desired gases and the like and of combustible substances and other additions and then allowing these bodies or compositions to burn. Such bodies or compositions which develop gases and the like have in general the following composition:

1. Substances which develop gases, vapours, smoke, fumes, or the like, for example perfumes, colouring materials, organic and inorganic salts, oils, tar fractions, resins, balsams, musk, ground coffee and so forth.

2. Substances which develop heat, for example, coal, sandal-wood powder, methaldehyde, paraffin and so forth.

3. Oxygen carriers, for example chlorates, nitrates, peroxides, permanganates and so forth.

4. Binding agents, for example nitrocellulose, dextrine, starch, gum tragacanth and so forth.

5. Catalysts, for example manganates, dioxide and so forth.

6. Adsorption agents, for example adsorption charcoal, kieselguhr, silica gel.

According to the present invention, the heat-developing substances mentioned under 2 above are replaced by semi-pyrophoric metals, one of these metals or a mixture of several of them or a mixture of one or more with other heat-developing substances being employed.

It is also known to develop gases and the like from masses or compositions in which certain reacting constituents are assembled together and, owing to the reaction of these constituents, the gas or vapour or the like is produced and at the same time the heat of the exothermic reaction is used for continuously supplying the heat for the vapourisation process. The easily combustible semi-pyrophoric metals can be used, in accordance also with the invention, in conjunction with such reacting constituents which develop the gas or the like. This is of particular advantage if the chemical reaction by which the gas is produced is only slightly exothermic or is endothermic and the vapourisation must be assisted by the heat of combustion of the metal.

The use of semi-pyrophoric metals in accordance with the invention offers further advantages depending on the applications to which they are put. The incandescing or smouldering process takes place without the production of flame. Therefore no production of light, which is often undesirable, occurs. The absence of a flame is also of particular advantage in those cases in which, medicinal or fumigating candles which are made in accordance with the invention and placed near the respiratory passages, which would not be possible if much flame were produced.

For perfumery purposes it is particularly important that no combustion gases should be formed by the agent which develops the heat, in order that the scents to be evolved can be obtained in a pure form, without being contaminated by a smell of burning or by noxious odours or by poisonous by-products. These are often produced by the heat-producing substances previously employed, such as for example methaldehyde and coal in which case carbon monoxide may sometimes be formed.

Owing to the absence of combustion gases which would rapidly conduct away the heat produced, higher temperatures can be obtained owing to the greater concentration of heat even in those cases where the heat capacity of the metals employed is smaller than that of the substances previously employed for developing the heat.

The gases, fumes, vapours and the like can be produced by a simple physical vapourisation of substance which are contained in the mass in solid or liquid form or by the thermal decomposition of compounds containing the constituents of the gas, or as above described by the production of a tertiary substance by means of a reaction between the constituents contained in the mass.

In so far as the substances which develop the gas or the like are themselves of an easily volatile nature they can be taken up by adsorption agents, such as adsorption charcoal. Obviously several different substances which produce gas or the like can also be employed simultaneously.

Catalysts can also be added both for assisting the ordinary combustion process, for example manganese dioxide, or also for accelerating the reaction by which the gas or the like is developed.

The masses used for carrying out the process may consist of loose powdery mixtures in which case a binding agent is not necessary. They can then be ignited on a refractory support or they can be shaped or pressed with or without a binding agent to form solid bodies, or they can be applied to carrier materials, such as for example wood, clay, porcelain, glass, magnesium, metal bodies and the like, or they can be filled into carriers made of such materials. In some cases these bodies may also be provided with means for producing the initial ignition, such as an igniting head, or a pull igniting device or the like.

One special field of application in which the heat producing process according to the present invention can be employed is in the vapourisation of iodine. For this purpose a mixture of semi-pyrophoric metal and an iodine compound or elemental iodine, which may if necessary be adsorbed in an adsorption agent such as adsorption charcoal, is combined by means of a binding agent and is applied to a suitable carrier material such as a glass or clay rod. When the mass on the carrier is ignited and caused to smoulder, the iodine vapourises and the quantity vapourised can be exactly regulated without any subsidiary odours being produced and can be used in the simplest manner for therapeutic purposes.

Another field of application is, for example, the production of heat with the aid of suitably formed bodies, tubes, rods, spirals or the like which contain semi-pyrophoric metals in the form of a powder or in a moulded or shaped condition, and are ignited at one end and then continue to glow or smoulder. The heat produced can then be utilised in other physical and chemical reactions, or for vapourisation, heating and the like or the bodies can be used as fuses or quick matches, that is to say only for passing on the heat-developing reaction.

It is possible, in accordance also with the invention, to employ the semi-pyrophoric metals for the manufacture of hand warmers, foot warmers, heating bodies for motor-cars or fillings for pressing irons and so forth. As compared with the known heat producing materials such as, for example catalyst heaters, coal or charcoal hand warmers and the like with which there is a danger of carbon monoxide poisoning, the heaters of the present invention have the advantage of being entirely free from danger.

A further field of application for semi-pyrophoric metals is in conjunction with sealing wax, sticks or cones and tubes of solder in which case the metals are preferably arranged in the interior of the cones or tubes. If the access of air to the metal is excluded then a substance which gives off oxygen, for example potassium chlorate, is added. When used in conjunction with tubes of solder a particular advantage is that no gases, which have a detrimental effect on the soldering, are formed.

In accordance also with a further feature of the invention, thermit mixtures of an aluminium, magnesium, calcium, silicon, or the like basis can be employed instead of or in addition to the semi-pyrophoric metals.

A rod or stick for developing useful gases, vapours, mists, or the like and made in accordance with the invention is illustrated by way of example in the accompanying drawing.

Referring to the drawing, the device consists of a rod, tube or similar structure 1 which is made of glass, clay, magnesia or the like, which is applied, preferably at one end, a mixture 2 which is made of one or other of the compositions which have been previously described, for example it may consist of 460 parts of semi-pyrophoric iron, 4 parts activated charcoal, 1 part iodine, and 30 parts of binding agent. The composition is applied to the carrier 1 by dipping the carrier several times into the mass while it is in a soft state.

Example 1

A mixture of 460 parts of semi-pyrophoric iron, 4 parts of activated charcoal and 1 part of iodine is stirred up with 30 parts of a binding agent to form a paste. A glass rod to which the material is to be applied is dipped into this paste and by dipping it in several times a coating of the paste is formed on the glass rod. After the binding agent has dried the mass can be ignited at one end and then smoulders slowly with the development of iodine vapour. The iodine vapour produced can be used for the treatment of catarrh.

Example 2

A small cube or cone of sealing wax of a size which is just sufficient for making a seal is filled internally to the extent of about one third of the total volume of the cube or cone of sealing wax with semi-pyrophoric iron, to which a substance which gives off oxygen, for example potassium chlorate, is added. The filling is made in such a way that, at an opening in the cavity containing the iron, the iron can be ignited by means of a match. Owing to the smouldering of the iron, the whole body of sealing wax, including its lower surface which rests on the paper or envelope to be sealed, is heated to such a temperature that the sealing wax can be pressed against it with the seal.

Example 3

A small cylindrical casing of solder of elliptical cross-section is encased with a mass composed of semi-pyrophoric iron and binding agent in such a way that the two ends of the cylinder of solder remain open. The two wires to be soldered together are introduced one beside the other into this sleeve of solder and can be provided beforehand with a small amount of soldering flux. If now the semi-pyrophoric mass is ignited the heat produced is sufficient to solder the two ends of the wires together.

ALFRED SCHMID.

PUBLISHED

JUNE 15, 1943.

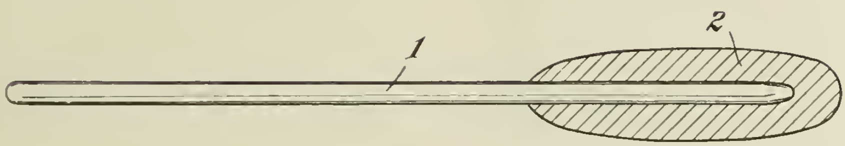
BY A. P. C.

A. SCHMID

HEATING PROCESS

Filed July 7, 1937

Serial No.
152,413



Inventor:
Alfred Schmid
By: Glascock Downing & Seebold
Attorneys

Published June 15, 1943 Serial No. 159,323

ALIEN PROPERTY CUSTODIAN

DISPERSIONS

Boerge Petersen, Juelsminde, Denmark; vested in the Alien Property Custodian

No Drawing. Application filed August 16, 1937

This invention relates in general to improved dispersions, having an aqueous disperse phase and organic substance as the continuous phase and to dispersion improving substances. It relates more specifically to improved edible dispersions, such as margarine and shortenings and to substances improving those edible dispersions.

The main object of the invention is to improve the stability of dispersions of the so-called water-in-oil type, that is to say dispersions having an aqueous disperse phase and oils or fats or other suitable organic substances, which may be oleaginous or non oleaginous, as the continuous phase.

Another object of the invention is to improve the degree of dispersion of the aqueous phase in water-in-oil dispersions.

A further object of the invention is to improve the stability and the degree of dispersion of water-in-oil dispersions having an acid reacting aqueous disperse phase.

Still a further object of the invention is to improve the stability of edible water-in-oil dispersions, such as margarine and shortenings.

Still another object of the invention is to improve the frying and baking qualities of margarine and shortenings.

Other objects and features of the invention will be apparent from a consideration of the following detailed description.

In the art of making dispersions of the water-in-oil type the stability of these dispersions is not only dependent upon the kind and amount of dispersing agent and stabiliser employed but also upon several other factors, such as the degree of dispersion of the aqueous liquid, the reaction of the aqueous liquid, the amount and character of the dry substance present in the aqueous liquid, the method and apparatus employed for making and if necessary cooling the dispersion, and in case of plastic dispersions the method and apparatus employed for kneading the dispersion. It is therefore very difficult if not impossible, to obtain from the same raw materials dispersions of exactly the same kind and composition, which are stable during their transport and storage, when these dispersions are made in different factories or even at different times in the same factory. Already very slight changes of the above mentioned factors may change the appearance and stability of the dispersions.

These disadvantages are avoided or lessened and dispersions of great stability and with a highly dispersed aqueous phase are obtained according to this invention, which consists in using as dispersing agent and/or stabiliser a condensation product of higher fatty acid, with more than 8 carbon atoms in the molecule, such as stearic, palmitic, oleic, linolic, linoleic and linolenic acids or their mixtures, and polysacharide, such as starch, dextrine, cellulose or degradation products thereof of a polysacharide type. The improvement according to the invention is especially noticeable, when the water or aqueous solution dispersed in the organic substance has an acid pH value, such as for example acidified skimmed milk, as used in the manufacture of margarine, in order to obtain a better quality of margarine.

The improvement according to the invention is obtained with all the condensation products of polysacharide and higher fatty acid, but those condensation products, which can be dissolved colloidally or molecularly in the organic substance, such as vegetable or animal oils, fats, fatty acids, waxes, alcohols, hydrocarbons and the like or mixtures of the same, forming the continuous phase of the dispersion, are especially suitable. The solubility of the condensation products in organic substances, especially animal, vegetable or mineral oils and/or fats, seems to depend upon the amount of fatty acid present in the condensation product, in such a manner that the solubility increases with increasing amounts of fatty acid present. The dispersing and stabilising action of the condensation products also seems to depend upon the amount of fatty acid present in the condensation product, but there is apparently a critical point, above which it is not an advantage to increase the amount of fatty acid. This point lies at about 60% fatty acid with a condensation product made from stearic acid and starch and in this case there should be free hydroxy groups of the polysacharide present in the condensation product. It is in many cases of advantage to employ a condensation product, in which not all the hydroxy groups of the polysacharide are substituted by fatty acid, these free hydroxy groups apparently having a favourable influence upon the dispersing and stabilising properties of the condensation products.

The invention is not limited to the use of the condensation products described alone as dispersion improving agents. Other dispersing and stabilising agents, such as oleaginous emulsifiers and stabilisers which form stable emulsions of the water-in-oil type, such as the emulsifiers prepared by polymerisation and/or oxidation of oils, fats or their mixtures may be used in combination with the condensation products.

The condensation products may also be used for stabilising dispersions of water or aqueous liquids in organic substances, which dispersion may contain other emulsifiers and/or stabilisers. In this case the stabilisation is carried out by distributing in the dispersion or dissolving in the dispersion, especially in the continuous phase, condensation products of higher fatty acid and polysacharide, if desired in admixture with other emulsifiers and/or stabilisers.

The manufacture of the condensation products of higher fatty acid and polysacharide is carried out by the usual methods, such as heating polysacharide and fatty acid halide, especially chloride, in the presence of inert liquids, such as pyridine, or by reacting fatty acid with polysacharide in presence of mono-chloro-acetic-acid-anhydride.

It is preferable to dissolve the condensation products in oleaginous substances, especially edible vegetable oils, and to use this solution, which may be a molecular or colloidal one, as dispersion improving substance.

The following examples serve to illustrate how the dispersions of this invention are produced:

1. 5 to 15 parts of a condensation product of dextrine and stearic acid, which condensation product contains about 60% stearic acid, are dissolved in 1000 parts of a fat mixture consisting of cotton seed oil, cocoanut oil and the like, and 200 parts of skimmed milk, acidified in the usual manner with the aid of bacteria, are dispersed in the melted fat mixture. Salt, colouring, aromatic and other suitable substances may be added, after which the finished dispersion is cooled and kneaded in the usual manner. The condensation product employed has such water-binding properties, that the margarine obtained is "dry," that is to say, it loses no water during its manufacture, transport and storage. As the water content does not change, the margarine always contains the desired amount of water, corresponding to the amount of water dispersed in the oil and/or fat.

The method employed for making, cooling and kneading the dispersion, the acidity of the skimmed milk, the amount of dry substance contained in the skimmed milk, and other factors, do not influence the dryness of the margarine, when employing a dispersion improving substance according to this invention.

The margarine obtained according to the example has other advantages, which appear to be due to the condensation product employed. Thus for example the colour and the taste of the margarine is not or only slightly influenced by light and air. The margarine also has good frying qualities. It does not spatter or only spatters slightly under normal frying conditions and it does not bake onto the bottom of the frying pan. The colour of the condensation product employed being white, the presence of this substance in the margarine has no influence upon the colour of the margarine. Then condensation product employed is also not decomposed by the bacteria present in the margarine, that is to say in the dispersed acidified skimmed milk. The condensation product employed is made from edible substance and is itself edible.

2. The same condensation product as described in Example 1 may also be used for making shortenings for bakery purposes, by dispersing water or other aqueous liquids in edible oils and/or fats. In this case the amount of dispersed aqueous liquid may be much higher than in margarine, for example 20–70%. The procedure may be the same as in Example 1.

3. 50 parts of water, containing perfume and, if desired, substances of cosmetic value, are dispersed in a mixture of 10 parts of vaseline, 10 parts of olive oil, 15 parts of wax, 10 parts of ceresine and 5 parts of the condensation product employed in Example 1. The resulting dispersion is cooled.

The term "higher fatty acid" as used in the claims, is employed to designate fatty acids with at least 8 carbon atoms in the molecule and the term "condensation product" to designate reaction products of polysacharide and fatty acid, in which one or several hydroxy groups of polysacharide are replaced by fatty acid, which reaction products also may be called esters.

BOERGE PETERSEN.

Published June 15, 1943

Serial No. 168,181

ALIEN PROPERTY CUSTODIAN

DEVICES FOR THE CONVEYANCE OF CIGARS DURING THEIR MANUFACTURE

Constantin Friedrich Röber, Dresden, Germany; vested in the Alien Property Custodian

Application filed October 9, 1937

This invention relates to devices for the conveyance of cigars or fillers during their manufacture.

The invention has for its object to provide an efficient device by means of which the fillers of cigars may be transported by step by step operation, and during such conveyance have their ends cut and placed on a conveyor for further handling of such fillers or cigars.

The invention consists of means for conveying cigars, combined with means for cutting off the ends thereof, and keeping the cigar or filler under control during such operations.

The invention will be more fully described hereinafter, embodiments thereof shown in the drawings, and the invention will be finally pointed out in the claims.

In the accompanying drawings:

Figure 1 is a side view of one form of the device, this form consisting of an endless apron passing over different operating stations, and this side view is shown rather diagrammatically;

Figure 2 is another embodiment of the invention also shown somewhat diagrammatically, and shows a plan view of a device in which the carriers are arranged to travel in a circular direction;

Figure 3 is a side view partly in vertical section, taken on line III—III of Figure 4;

Figure 4 shows a plan view of Figure 3;

Figure 5 shows a part of Figure 3 showing details thereof;

Figure 6 shows a side view of Figure 5; and

Figure 7 shows a horizontal section taken on line VII—VII of Figure 3.

Similar characters of reference indicate corresponding parts throughout the various views.

Referring to the drawings and more particularly to Figure 1, the embodiment therein shown consists of an endless conveyor or belt **1** which passes over the chain wheels **2** and **3**. Upon this belt **1** there are arranged a plurality of spaced carriers **4**. The edge of the carriers **4** is provided with two suction heads *a* and *b*. Below the belt **1** there are arranged various stations, the filler receiving station A, the filler device B, the cutting device C, and the delivery station D. At the filler receiving station A the press forms **5** are moved in the press moulds on which the cigar fillers Z rest. As soon as the carrier arrives at a position corresponding to a position above the filler receiving station A, the foremost cigar filler is moved by suitable means, for example, a suction head, and swings upwardly and is given over to a suction head *b*. As soon as this carrier reaches the position over the filler device B, the filler provided with a covering leaf is lifted and given over by suitable means to the suction head *a*. As soon as the carrier arrives in the position indicated by the dot dash lines, it gives up the filler carried by the suction head *b* and delivers it to the filler device. With a further movement of the carrier **4** in the direction indicated by the arrow, the suction head *a* arrives in a position over the cutting device C. In connection with this cutting device, there is arranged a gripper **6** which engages with the suction head, and this gripper **6** takes over from the suction head *a* the cigar carried thereby, and by means of a descending swinging movement into the position indicated by dot dash lines in Figure 1 holds the cigar in proper position in respect to the cutting means.

During this cutting process, the carrier moves further, and as soon as the suction head *b* arrives over the cutting position, the gripper **6** is swung upwardly and moves the cut cigar to the suction head *b* which then holds the cigar.

As soon as the carrier **4** arrives in the position of the delivery device D, the suction head *b* is operated to cut off the suction action, and the cigar falls upon an endless band **7** which guides the completed cigars to devices necessary for the further operation in the manufacture of cigars.

It is clear that the distance between the two suction heads *a* and *b* can be so devised that ample time is provided to permit the cutting operation to take place. It is, of course, true that in this case the time element between the delivery of the completed cigar from the filler device and the insertion of a new filler in the filler device is dependent upon the distance between the two suction heads *a* and *b*.

In Figures 2 and 7 a structure is shown which takes into consideration this time element, and in this structure the operation is such that the time element between the removal of the cigar out of the filler device and the insertion of a new cigar is independent of the time which the cigar requires while in the zone of the cutting operation C.

Referring more particularly to the structure shown in Figures 2 to 6, there are arranged three suction heads **8**, **9**, and **10**, which are supported by a hollow arm **11** which in turn is supported by a vertically disposed pipe or tube **12**. Between the arm **11** shown in Figure 2 and the tube **12** shown in Figure 3, a curved portion **11'** is provided. The tube **12** is journaled in a cylinder **13**

and is rotatable in respect thereto, the flange 13' serving as a fastening device.

The suction heads 8, 9, and 10, which have at their lower sides a slot like opening, are each provided with a tube like extension 14. These tube like extensions 14 engage with and are supported by sleeves 15 of the arm 11 and are fastened thereto. For each tube like extension 14 there is provided an upwardly extending bore 16 in which there is placed a cylinder 17. In the cylinder 17 is a sleeve 18 journaled so as to be able to rotate, which sleeve is open at the bottom and carries to its upper part an extension 19. In each of the extensions 19 there is arranged a pinion 20 which is secured to each extension 19. On the cylinder 17 and within the sphere of the hollow part of the arm 11', there is provided a slot 17'. With this slot 17' another slot 18' of a sleeve 18 may be brought into registration whereby the hollow space of the curved part 11' of the arm 11 is brought into connection with the suction head 8 or 9 or 10, as the case may be. On the other hand, the sleeve 18 may cover the slot 17', depending upon the actuation of the parts. A suction device is indicated with the lower part of the tube 12. This suction device is not shown in the drawings, as it is well known.

With each pinion 20 a gear segment 21 is engaged, which segment 21 is fastened to a lever 22. The lever arm 22 is, by means of a stud 23, journaled to the arm 11, and is indicated with a governing arm 24. The governing arm 24 grips by means of a roll 25 in the cam slot 26 which is provided in the ring like governing disc 27. The arm 22 is connected with a further lever 29 by means of a guide link 28, which lever 29 has at its end a gear segment 30. This gear segment 30 is connected with the pinion 20 which is disposed in position in respect to the suction head 10.

The pinion 20 which is disposed in position for the suction head 9 is engaged by a gear segment 31 which is fastened to the lever arm 32. The lever arm 32 is journaled on the stud 33 placed on the arm 11, and on the lower end of this stud 33 there is arranged a governing lever 34 as seen in Figure 3. One end of the governing lever 34 engages with a roll 35 into the cam slot 36. The cam slot 36 is arranged on a ring disc 37 which is common with the curve or cam slot disc 27, being joined thereto by an extension 38 on the cylinder 13 and fastened thereto. The other end of the governing lever 34 has a roll 39 which engages within the sphere of the suction head 9.

On the suction head 9 there is arranged a gripping finger 40 as seen in Figure 6, which is fastened to the shaft 41. The shaft 41 is journaled in a journal arranged on the suction head 9, and is provided with a pinion 42. The pinion 42 is engaged by a toothed segment 43 which is on a pivoted plate 44. The plate 44 is pivoted on a pivot shaft 45 on the other side of the suction head 9, and is also provided with a curved cam surface 46 which is acted upon by the roller 39. By means of the flange 47, there is secured to the cylinder 13 a tube 48.

As is seen in Figure 7, the wall of the cylinder 13 is provided with a bore 13'' which connects with the bore 12' of the tube 12 and thereby a communication between the interior of the tube 12 and the interior of the tube 48 is provided. Upon the free end of the tube 48 there is applied by suitable screw means a further tube 49 which terminates in a suction head 50 as shown in Figure 3. The slot of the suction head 50 faces upwardly, as shown in Figure 3.

Next to the suction head 50 the two cutting devices 51 are arranged, each of which consists of a member which cooperates with the governing means described in order to operate the cutting device, but which connections are not indicated in the drawings.

It is here to be noted that the suction head 50 immediately comes under the action of suction when the suction head 8 arrives in a position immediately above the suction head 50. The suction action remains so long until the suction head 10 is moved over the suction head 50. For this purpose, the tube 12 cooperates as above described by means of its bore 12' with the bore 13'' as shown in Figure 7.

The operation of the arm 11 results from the cooperation of a pinion 56 which engages with a geared wheel 57 arranged on the tube 12, as shown in Figure 3. Suitable means not shown cooperate with the pinion 56 in order to rotate it.

The operation of the device is as follows: As soon as the arm 11 has been turned so far that the suction head 9 arrives in the position indicated in Figure 2 by x, then the suction head 52 which is fastened to the swinging arm 53 gives to the suction head 9 a cigar taken out of the press form 54. The press forms 54 are moved step by step on the track 55 in the direction of the arrow shown in Figure 2. The press forms 54 move in such a manner that with every rotation of the arm 11' new filler is placed within the reach of the grippers 52—53 of Figure 2.

When the suction head 10 arrives in the position indicated by y in Figure 2, then by means of the curved cam slot 26 the air of the suction head 10 is cut off, so that the cigar carried by the suction head or gripper 10 is placed upon the conveying band 58 which then conducts the cigars to a collecting place.

When, as a result of the swinging arm 11, the suction head 8 is placed over the central part or center of the filler device 59, then in a well known manner, by means of a lever, the finished cigar is taken out of the filler device and pushed on to the suction head 8. At this point of time, the suction head 8, by means of the curved cam slot 26 is again placed under suction action so that by the further movement the completed cigar is again taken up by the suction head 8. As soon as the suction head 9 reaches a position over the central part or center of the filler device 59, then the air is cut off from the suction head by means of the curved guide 36 so that the cigar carried thereby is given over to the carrier of the filler devire. As soon as the suction head 8 has arrived over the suction heal 50 (see, for instance, the extended position in accordance with Figure 2), then the suction air of the suction head 8 is again cut off and the suction of the suction head 50 is placed under actuation. During the further movement of the arm 11, the cutting portions of the devices 51 enter into activity and bring about the cutting off of the ends of the cigars. As soon as the arm 11 has been moved so far that the suction head 10 is over the suction head 50, then the suction air of the suction head 50 is cut off, and the suction head 10 is set into suction activity so that the cigar can be taken along by the suction head 10.

The fillers coming out of the press forms 54 are very often somewhat rough on their outer surface. Thus, they contain loose leaf portions. In view thereof, it can happen that the filler may fall off from the suction head 9 due to the relatively rapid movement of the arm 11. In order

to overcome this objection, a holding finger **40** is provided as shown in Figure 6, which after the filler has been taken over and supported by the suction head **9**, moves out of the dot dash lines position shown in Figure 6 into the full line position, and thereby supports the filler and prevents its falling off from the suction head. The swinging movement necessary for this finger **40** is brought about by means of the arm **34**, which at the same time, with a corresponding transposition of the tube **13**, is given a suitable relative movement in respect to the suction head, and by means of the curve the finger is brought into the necessary and desirable position of operation. This finger **40**, after the suction head **9** is brought within the sphere of the filler device, is swingable upwardly through a corresponding similar relative movement of the arm **34**.

CONSTANTIN FRIEDRICH RÖBER.

PUBLISHED

JUNE 15, 1943.

BY A. P. C.

C. F. RÖBER
DEVICES FOR THE CONVEYANCE OF CIGARS
DURING THEIR MANUFACTURE
Filed Oct. 9, 1937

Serial No.
168,181

2 Sheets-Sheet 1

Fig. 1

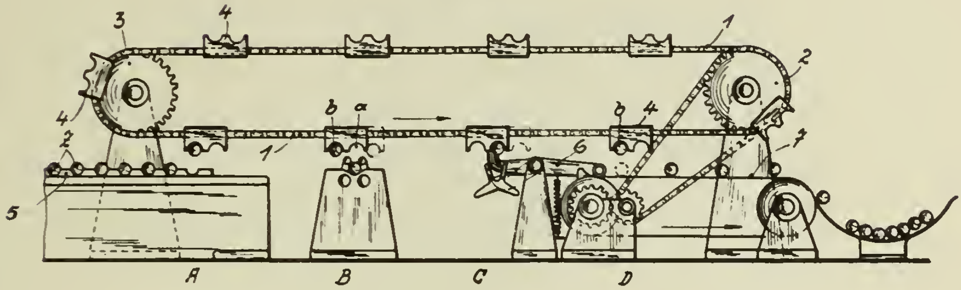


Fig. 2

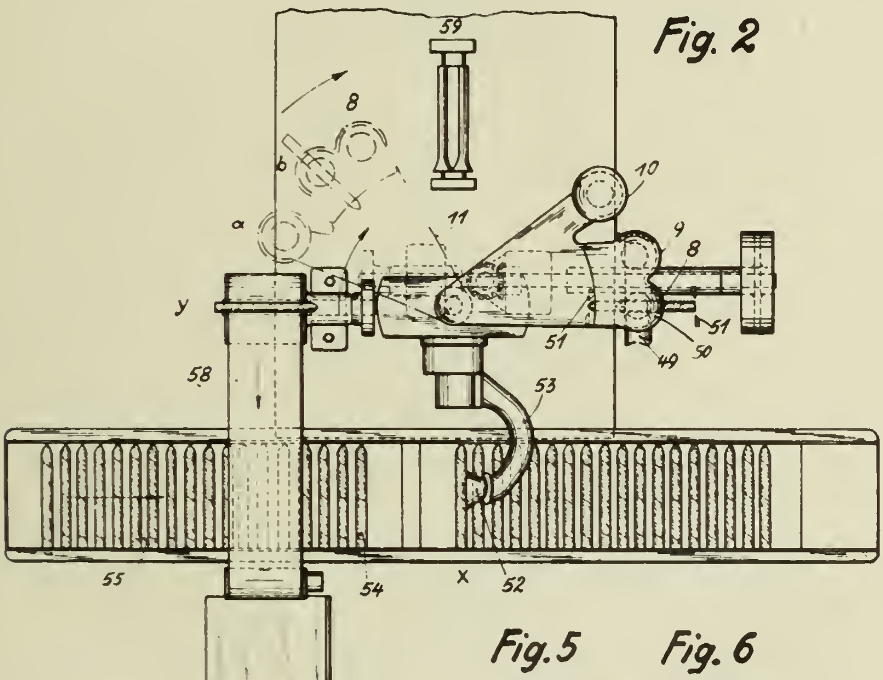


Fig. 5

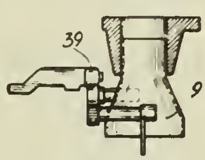
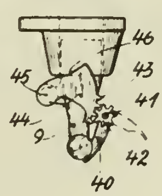


Fig. 6



INVENTOR
Constantin Friedrich Röber
By C. P. Goepel
his ATTORNEY

PUBLISHED

JUNE 15, 1943.

BY A. P. C.

C. F. RÖBER
DEVICES FOR THE CONVEYANCE OF CIGARS
DURING THEIR MANUFACTURE
Filed Oct. 9, 1937

Serial No.
168,181

2 Sheets-Sheet 2

Fig. 3

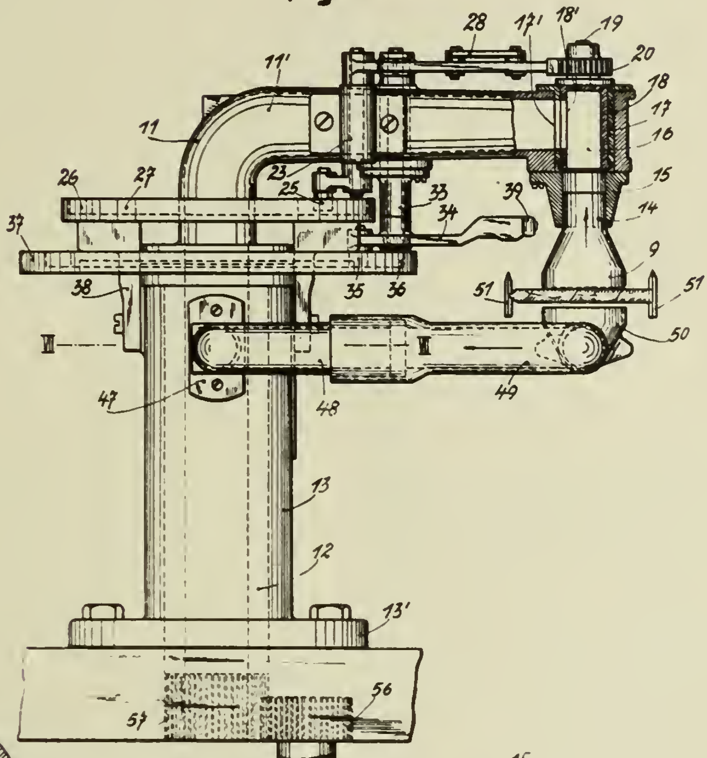


Fig. 7

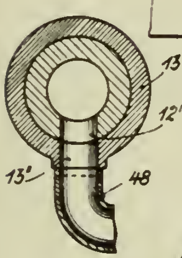
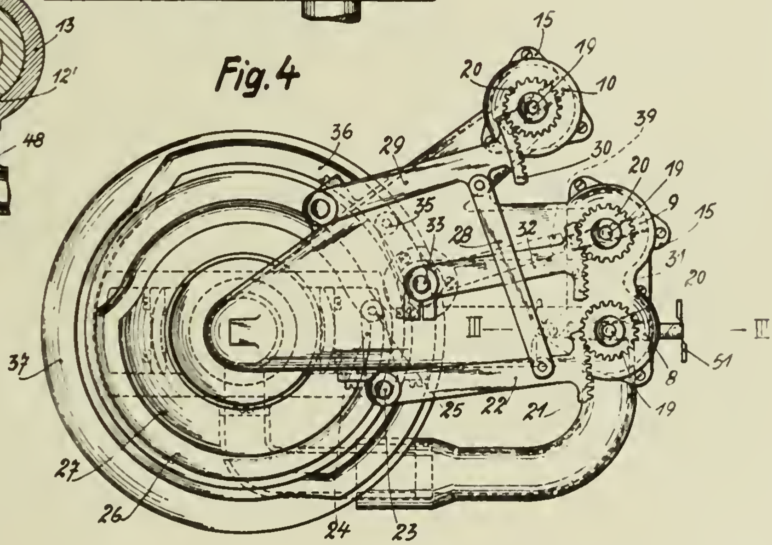


Fig. 4



INVENTOR
Constantin Friedrich Röber
BY C. P. Goepel
his ATTORNEY

Published June 15, 1943 Serial No. 178,648

ALIEN PROPERTY CUSTODIAN

SEMI-STIFF MULTI-LAYER FABRICS AND A PROCESS OF PREPARING THEM

Franz Streng, Frankfurt am Main, Germany; vested in the Alien Property Custodian

No Drawing. Application filed December 8, 1937

The present invention relates to semi-stiff multi-layer fabrics and to a process of preparing them.

Publications concerning the mercerization of cotton mixtures containing artificial silk afford the information that the artificial silk fiber may be affected thereby and that the dilution of the mercerizing liquor occurring during the washing process may cause the formation of water-soluble sodium cellulose and the swelling of the artificial silk fiber.

Now, I have found that semi-stiff fabrics may be prepared by treating viscose artificial silk fabric or cuprammonium artificial silk fabric at ordinary temperature with caustic soda solution of 12°–20° Bé, pressing it together with another fabric and then rinsing, if desired, after acidifying. The other fabric may be of the same kind as the artificial silk fabric treated with caustic sode solution or it may be prepared from cotton or linen or any other fibrous material. It may be treated, before pressing, with caustic soda solution in the manner above described for the artificial silk fabric. An improvement of the semi-stiff fabric as well as of its manufacture is obtained by adding urea or thio-urea to the caustic soda solution.

The artificial silk fabric treated with caustic soda solution is pressed together with the treated or non-treated fabric, for instance by passing the super-imposed fabrics through a squeezing device or a foulard provided with two rollers. The pressure applied upon the fabrics should not be so high as to destroy the threads of the artificial silk fabric treated with caustic soda solution. By the pressure applied the webs of fabrics are united to form a semi-stiff fabric permeable to the air which resists long boiling even in soap baths.

The following Examples serve to illustrate the invention, but they are not intended to limit it thereto:

(1) A fabric made from coarse-threaded or fine-threaded viscose artificial silk interposed between two cotton fabrics is passed together with the cotton fabrics through a caustic soda solution of 15° Bé; the whole is then squeezed on an ordinary foulard provided with two rollers, rinsed, acidified, rinsed and dried. A stiffened compressed fabric is obtained which is permeable to air and does not lose its stiffness when soaped for several hours.

(2) The fabrics referred to in Example 1 are treated with a caustic soda solution of 15° Bé to which 50–100 grams of urea or thiourea are added; there is obtained a fabric which is still stiffer and better welded together than the multi-layer fabric obtained according to Example 1 and has the same good fastness to washing and soaping.

(3) A viscose artificial silk fabric treated with a caustic soda solution of 14° Bé which may also contain urea is brought together with one or two webs of cotton material only directly before the squeezing device; a stiffened multi-layer fabric is obtained which has the same properties as the products obtainable according to Examples 1 and 2.

FRANZ STRENG.

Published June 15, 1943

Serial No. 180,047

ALIEN PROPERTY CUSTODIAN

PROCESS FOR THE MANUFACTURE OF SAFETY PAPER

Adolf Schroth, Neu-Kaliss, Germany; vested in the Alien Property Custodian

No Drawing. Application filed December 15, 1937

This invention relates to a process for the manufacture of safety paper.

So-called safety paper is used for documents of various kinds, for example cheques, for preventing falsification especially with the aid of chemical agents. It is necessary for such paper to give a distinctly visible reaction with acids, alkalis, oxidising agents and reducing agents. Consequently a number of different reagents must be added to the paper This gives rise to difficulties when the reagents also react upon one another, so that the discolouration which is intended to indicate the falsification occurs prematurely. It is obvious that a safety paper of this nature would be useless.

Such difficulties can occur for example if the attempt be made simultaneously to incorporate in the paper a reagent which reacts with reducing agents and a reagent which reacts with acids, because reagents which are effective for indicating falsification effected with the use of reducing agents must be very sensitive, since forgers only use very mild reducing agents in order not to damage the paper itself.

Now the present invention relates more especially to a process which enables reagents which are sufficiently sensitive to reducing agents and reagents which are sensitive to acids to be added simultaneously to the paper pulp.

Known indicators for acids are certain metallic salts, for example iron cyanogen compounds such as manganese ferro-cyanide, copper ferrocyanide, or cobalt-ferrocyanide, which may be used either alone or in combination with iron salts. These compounds also give a reaction with oxidising agents. If an attempt be made to add these substances to a paper which contains, as the reagent sensitive to reducing agents, an inorganic salt for example which can be easily reduced to the metal, the later reaction with a reducing agent becomes impossible because the aforesaid salts and cyanides act prematurely on the inorganic salt and effect reduction.

The undesired reducing action of the acid indicators is due to the fact that directly they are introduced into the hollander they split off sufficient ions to effect reduction. The ion formation in the hollander as well as on the drying apparatus of the paper machine, where definite thermo-electrical processes take place, is promoted by the acidity of the pulp due to its content of alum which is necessary for sizing. Owing to this ion formation, the metal is separated from the inorganic salt which acts as the indicator for reducing agents either in the hollander or at the latest in the paper machine and premature discolouration of the material therefore occurs. Although, when the paper pulp has a neutral reaction, the formation of ions is only small, nevertheless the solubility product is still so great that the ions which are split off have sufficient reducing power. It must also be mentioned that the substances, for example the said iron cyanogen compounds, which are employed as indicators for acid are often contaminated by ionisable salts, for example iron salts, so that the number of free salt ions is thereby increased.

Also when the paper is stored discolouration can occur subsequently, since owing to the catalytic action of light and moisture decomposition and ion formation may occur in consequence of photolysis.

The aforesaid disadvantages are obviated by the process according to the present invention. The process of invention enables suitable metal compounds, for example iron salts or iron cyanogen salts which themselves have a strong reducing power, to be incorporated in the paper pulp as acid indicators together with easily reducible substances, for example easily reducible inorganic salts, without reduction of the inorganic salt being effected and discolouration of the paper being caused owing to separation of the metal.

In accordance with the invention, the metal compounds, for example iron salts or iron cyanogen salts which act as the acid indicators, are converted before or during their addition to the paper pulp or to the paper into only slightly dissociated, and in particular colourless or only slightly coloured complex salts of the metals of the sixth group of the periodic system which form acids or polyacids, for example into iron tungstate, ammonium-iron-cyan-tungstate or ammonium-iron-cyan-molybdate, or are mixed with buffering agents for example alkali metal salts of phosphoric or boric acid, which immediately take up ions occurring in the nascent state for example iron or cyanogen ions, and convert them into undissociated compounds.

It is known simultaneously to incorporate in safety papers indicators for acids and for oxidising agents, for example an iron salt and potassium-ferrocyanide as the acid indicator and manganese sulphate as the indicator for oxidising agents. In this case, however, the two different reagents do not react upon one another in the paper pulp. There is no question in this case of preventing any mutual reaction between the various reagents in the paper pulp or in the paper, though it was important in the known process

provisionally to separate the components of the acid reaction one from the other and to fix the corresponding metal precipitates on the fibres which was effected by means of resin compounds of the metal salts. This has nothing whatever to do with the present invention.

It is also known to effect a kind of buffering in order to protect the safety paper from external and atmospheric influences, for example by regulating the pH value of the finished paper to a definite value, so that the occurence of the discolouration which indicates the falsification can be determined. Finally an attempt has been made to prevent falsification by incorporating ink fixatives in the safety paper. In this case the ink fixative can again be protected by a stabilising agent. None of the known proposals however has been concerned in any way with enabling indicators for acids and for reducing agents to be incorporated simultaneously.

According to the first of the aforesaid methods of the invention, the iron or iron cyanogen molecule is converted into a colourless or only slightly coloured complex salt of a metal of the sixth group of the periodic system which forms acids or polyacids, for example tungsten. In these complex salts the iron or iron-cyanogen molecule is firmly joined to the central atom by a principal valency bond or by a residual valency bond. The complex salts are of surprising stability owing to their high molecular composition and are characterised by a very low power of dissociation. Further, if any slight dissociation should occur, the iron and the iron-cyanogen occur for the most part not as free ions but as complex ions, and no free ions having sufficient power prematurely to reduce the inorganic salt to the metal and thereby produce discolouration are therefore formed.

When paper which contains the iron or iron-cyanogen molecule in the form of these complex compounds is treated with acids, the complex compounds are frequently decomposed into the simple salts which possess a greater power of dissociation.

It frequently happens, however, that low molecular, highly coloured complex salts are formed by the action of acids on the colourless or only slightly coloured high molecular salts whereby a discolouration of the paper is produced.

According to the second of the aforesaid methods, an alkali metal salt, for example of phosphoric or boric acid is added, for example, to the iron or iron-cyanogen compound. The iron or iron-cyanogen ions which are in the nascent state are immediately taken up by these salts which act as stabilisers or buffering agents and are converted into insoluble compounds, the solubility product of which is so small that they cannot form sufficient free ions to be able to reduce the inorganic salt to the metal.

Example 1.—To the paper pulp in the hollander which contains an inorganic salt which is capable of being reduced to elemental form, for example mercury tungstate or barium tellurite or barium selenite, precipitated colloidal iron tungstate is added and the paper is impregnated with a solution of complex ammonium-iron-cyan-tungstate. The iron tungstate and ammonium iron-cyan-tungstate act in conjunction in the finished paper as an indicator for detecting acids.

Example 2.—The paper pulp which contains an inorganic salt which is capable of being reduced to elemental form is impregnated with a solution of ammonium iron-cyan-molybdate which acts as the indicator for detecting acids.

Example 3.—To the paper pulp in the hollander which contains an inorganic salt which is capable of being reduced to elemental form there is added precipitated colloidal iron tungstate and the paper is impregnated with a solution of potassium ferrocyanide which contains an alkali metal salt of phosphoric acid or boric acid as a buffering agent.

The paper pulp can also be impregnated only with alkali potassium-ferrocyanide solution to which an alkali metal salt of phosphoric acid or boric acid is added as a stabiliser.

ADOLF SCHROTH.

Published June 15, 1943

Serial No. 184,967

ALIEN PROPERTY CUSTODIAN

PLASTIC DISPERSIONS

Herbert Schou, Juelsminde, Denmark; vested in the Alien Property Custodian

No Drawing. Application filed January 14, 1938

This invention relates to improved plastic dispersions of water or other aqueous liquids as the disperse phase in edible fatty acid glyceride having a melting point above 10° C as the continuous phase. It relates more specifically to household margarine, bakery margarine, shortenings and similar foodstuffs or products used in the manufacture of foodstuffs.

The main object of the invention is to provide for plastic dispersions of the above described type which are dry, that is to say plastic dispersons, which do not lose or only lose a very small part of their aqueous phase during transport and storage.

Another object of the invention is to provide for plastic dispersions of the above described type which are dry under any circumstances, even if the raw materials and the methods and apparatus used for their manufacture are different in amount, character and kind.

Still another object of the invention is to provide for plastic dispersions of the above described kind, which although not very stable when liquefied by moderate heating do not give off part or give off only a very small part of their aqueous constituent at room temperatures, when they are plastic.

I have discovered that plastic dispersions of water or other aqueous liquid as the disperse phase in edible fatty acid glyceride with a melting point above 10° C as the continuous phase are dry compared with other known edible plastic dispersions when they contain an ester of a polyhydric alcohol compound and a higher fatty acid, said ester having at least one free hydroxyl group of the alcohol compound and at least one oxidised and preferably also polymerised fatty acid radicle.

By a polyhydric alcohol compound I understand the polyhydric alcohols, such as the different glycols, glycerol, erithritol, mannitol, sorbitol and the like polyhydric alcohols, or their polyhydric alcoholic compounds obtained by condensing or polymerising the above mentioned polyhydric alcohols. Examples for polyhydric condensation products of polyhydric alcohols are diglycerol, triglycerol and other polyglycerols and examples for polyhydric polymerisation products of polyhydric alcohols are the highly viscous glycerol polymerisates. By higher fatty acid I understand fatty acids with at least 8 carbon atoms, such as the fatty acids present in animal or vegetable oils or fats.

Of the fatty acid radicals combined with the polyhydric alcohol compound at least one of the radicles must be oxidised and preferably also polymerised, whereas the other fatty acid radical or radicles present may be untreated fatty acid radicles, such as stearic, palmitic, oleic acid radicles and the like. It seems however, that better results are obtained, when several or all of the fatty acid radicles combined with the polyhydric alcohol compound are oxidised and preferably also polymerised.

The manufacture of the esters of the polyhydric alcohol compound to be present in the plastic dispersions according to the invention may be carried out in different manners. Thus for example oxidised and if desired polymerised fatty acids may be esterified with such an amount of polyhydric alcohol compound, that the ester formed contains at least one free hydroxyl group of the polyhydric alcohol compound.

Also esters of the oxidised and if desired polymerised fatty acids may be reesterified with such an amount of the polyhydric alcohol compound, that the ester formed contains at least one free hydroxyl group of the polyhydric alcohol compound. One may also esterify unsaturated higher fatty acids or reesterify their esters with such an amount of the polyhydric alcohol compound, that the esters formed contain at least one free hydroxyl group of the polyhydric alcohol compound, and thereafter oxidise and, if desired, polymerise the unsaturated fatty acid radicles present in the esters formed by the esterification or reesterification described.

The oxidation of the fatty acids combined with or to be combined with the polyhydric alcohol compounds may be carried out in different manners, for example by treating fatty acids, especially unsaturated fatty acids, or their esters, such as the triglycerides, with oxidising agents at room temperature or at raised temperature. The polymerisation of the fatty acids combined with or to be combined with the polyhydric alcohol compounds may be carried out by a heat treatment prior to, simultaneously with or after the oxidation. Also a prolonged oxidising treatment without heating may lead to a polymerisation of the fatty acids. A very suitable method for the manufacture of oxidised and polymerized higher fatty acids is for example described in U. S. specification 1,603,155.

The dispersion improvers according to my invention may be added to the dispersions by dissolving them in the edible fatty acid glyceride prior to the preparation of the dispersion. They may however also be added to the dispersion during or after the dispersing operation. This

dispersing operation is carried out at raised temperatures, such as 30–50° C, and the dispersion is thereafter cooled and if necessary plasticised by kneading and/or rolling. As the dispersion improvers according to the invention do not furnish dispersions of great stability, as long as the dispersions are liquid in the course of their manufacture, it is advisable to solidify the liquid dispersons immediately after their preparation by cooling. When solid the dispersions are very stable and this appears to be due to the great water-binding power of the dispersion improvers according to my invention.

The dispersion improvers according to my invention may be employed in combination with other known dispersion improvers, such as oxidised and/or polymerised triglycerides of higher fatty acids, mono- or diglycerides of stearic acid, palmitic acid and similar untreated higher fatty acids, esters of stearic, palmitic and similar untreated higher fatty acids with polyhycerols with or without free hydroxyl groups of the polyglycerols, lecithin, cholesterol and the like.

The amount of the dispersion improvers according to the invention present in the plastic dispersions may vary from 0,1–10% or more. Generally only small amounts from about 0,1–2% are necessary.

1. 100 parts of dispersion improved prepared in accordance with U. S. specification No. 1,603,155 are mixed with 30 parts of anhydrous glycerol. The mixture is heated while being intensively stirred to about 180°–200° C in an atmosphere of carbon dioxide. A catalyst such as tin in the form of granules is present. The heating is continued until a sample of the mixture, freed from excess of glycerol, has the desired hydroxyl number. This hydroxyl number indicates the amount of monoglycerides and/or diglycerides present. The heating is stopped when about 70% of the original triglycerides are converted into mono- and/or diglycerides. The free glycerol is then removed from the reaction mixture by centrifugalizing, the oily residue constituting the dispersion improver, which consists mainly of mono- and/or diglycerides and some triglycerides.

5 to 15 parts of this dispersion improver are dissolved in 1000 parts of a melted fat mixture consisting of cotton seed oil and coconut oil. 200 parts of skim milk, acidified in the usual manner with the aid of bacteria, are dispersed in the melted fat mixture. Salt, colouring matters, aromatic and other desirable substances may be added before, during or after the dispersing operation, after which the product is immediately cooled below its melting point and plastified by kneading in the usual manner. The dispersion improver employed possesses such water-binding properties that the margarine obtained is dry, that is to say, it loses no water during its manufacture, transport and storage. The method employed for making, cooling and kneading the dispersion, the acidity of the skim milk and the amount of dry material contained in the skim milk, do not influence the dryness of the margarine, when employing the dispersion improver prepared as described above.

2. The same dispersion improver as described in Example 1 may also be used for making shortenings for bakery purposes consisting of about 33% of aqueous liquid dispersed in edible fatty acid glyceride.

In the two examples the triglycerides present in the dispersion improver may be removed, for example by treatment with suitable solvents, such as ethyl alcohol, in which the mono- and diglycerides present are soluble and the latter may be used alone as dispersion improver. The glycerol may be wholly or partly replaced by glycol, erithritol, mannitol or sorbitol.

3. Water-free glycerol, purified by distillation, is heated to about 260° C in an atmosphere of carbon dioxide or other inert gases in the presence of a catalyst, such as 2% sodium acetate, for about 72 hours. The yellow product obtained has a viscosity of above 1000 Centipoise at 50° C, measured with the Höpler viscosimeter. The polymerisate is apparently colloidal in character.

One part of the polymerisate is added to 3 parts of soya oil and this mixture is heated to about 260° C in an atmosphere of carbon dioxide or other inert gases for about one hour in order to effect esterification of the glycerol polymerisate by reesterification. On cooling the reaction mixture is centrifugalized to remove from the mixture of different fatty acid esters obtained the water-soluble glycerol and glycerol polymerisate which may be present.

The mixture of fatty acid esters obtained is then subjected to a polymerisation and/or oxidation in a similar manner as described in U. S. specification 1,603,155 and the product thus obtained is used as dispersing agent in the manufacture of margarine or shortenings in the same manner as described in Examples 1 and 2.

The glycerol polymerisate of the example may be replaced by glycerol condensates, such as diglycerol and triglycerol, or by polymerisates or condensates of other polyhydric alcohols, said condensates or polymerisates containing at least two hydroxyl groups. The soya oil of the example may be replaced by other drying or semi-drying oils and/or fats or mixtures of non-drying and drying and/or semi-drying oils and/or fats.

The soya oil of the example may also be replaced by fatty acids or by polymerised and/or oxidised oils and/or fats prepared according to the U. S. specification 1,603,155 or by fatty acids obtained from these oxidised and/or polymerised oils and/or fats and in this latter two cases the subsequent oxidation and/or polymerisation of the product obtained by the esterification with the glycerol polymerisate is not necessary.

The dispersing agent obtained according to Example 3 may also be freed from esters, which do not contain free hydroxyl groups, for example by treatment with solvents, such as ethyl alcohol, in which these esters are insoluble, whereas the esters with free hydroxyl groups are soluble and the latter alone may be used as dispersing agents.

HERBERT SCHOU.

Published June 15, 1943 Serial No. 187,354

ALIEN PROPERTY CUSTODIAN

HEAT ENGINES OPERATING WITH TWO DIFFERENT FLUIDS WHICH ARE SUBJECTED TO THE SAME TEMPERATURES AND NOVEL APPLICATIONS OF SAID ENGINES

Jean-Léon Reutter, Paris, France; vested in the Alien Property Custodian

Application filed January 28, 1938

The present invention, Reutter's system, relates to heat engines which have a movable wall which is common to two fluid-tight chambers each containing a different fluid. The displacements of said wall, which are utilised for producing work, being produced by the variations of the temperature which is common to the two fluids. If the variations of pressure are small, the thrust on the movable wall can be as great as desired since, other things moreover being equal, it is proportional to its area.

Taking advantage of this possibility which enables considerable mechanical energy to be obtained for small variations of temperature of the fluids, the invention relates to the novel application of the heat engines of the kind indicated to the construction of thermostats for the direct control of members or mechanisms in which the resistance energy to be overcome is considerable. Thus, without decreasing the sensitiveness, considerable strokes and forces can be obtained for relatively small differences of temperature. It is known that the known thermostats, which are all based on the expansion of liquids or of solids, can only be sensitive conditionally on transmitting extremely reduced forces.

The invention also covers the application of the same engines to the construction of electric contact apparatus for controlling circuits from which any desired effects can be obtained. The electric contacts are arranged in one of the chambers of the heat engine with an atmosphere of which the nature and the pressure are chosen to prevent break sparks and arcs and the oxidization or the deterioration of the contacts.

It is possible to use said contacts for controlling the common temperature of the two fluids of the engine. It suffices for this purpose to maintain the temperature of the fluids by means of electric heating resistances the supply of which is placed under the control of the contacts which are actuated by the movable wall of the engine.

The engines thus arranged permit of the realization of accurate pressure gauges and of all apparatus of the same nature such as barometers and altimeters. In these apparatus, by applying the invention, all the elements which are a cause of errors in the known instruments are eliminated. It is known in fact that aneroid pressure gauges and barometers or altimeters are always inaccurate, owing to causes which are inherent to the metal capsule and such as:

Mechanical hysteresis in the resilient deformation of the metal;
Permanent deformations;
Ageing of the metal.

According to the invention, this drawback is overcome by utilising gas-filled capsules of which the temperature is kept constant by the action of electric contacts which are actuated by a heat engine of the kind referred to, a chamber which is in communication with the fluid of which it is desired to measure the pressure being thus kept at the temperature of the capsule by the same means, and the variations of volume of the very thin and very flexible walled capsule exactly expressing the variations of pressure of the surrounding fluid.

The accompanying drawing shows, only by way of examples, embodiments of the above-defined improvements and novel applications.

Fig. 1 is a diagrammatic axial section of a thermostat for the direct control of a cock.

Fig. 2 is an axial section of a heat engine applied to the control of an electric contact-breaker.

Fig. 3 is a similar view to Fig. 2, for a modification of construction.

Fig. 4 is an axial section of an improved apparatus which can be utilised as a pressure gauge, a barometer or an altimeter.

Fig. 5 is a modification of construction of the apparatus of Fig. 4.

Fig. 6 is a vertical axial section of a gravimeter.

In the embodiment of Fig. 1, the novel application has been considered of the heat engines of the kind indicated, to the construction of a thermostat which is used directly for the control of members which offer a considerable resistance energy. In this example, the member to be controlled is a cock **39** of which the plug, which is provided with a lever **40**, is connected by a connecting rod **41** to a rod **42** which is fixed at one end to the movable wall **43** of the heat engine. Said wall **43** is arranged inside a box **44** and the wall **45** is resiliently deformable. The rod **42** is arranged in a deformable sheath **46** which is fluid-tightly fixed to the wall **43** and to the end **47** and is open at its outer end for the passage of the rod **42** which may, on the other hand, be guided rectilinearly by any appropriate means, not shown. With this arrangement an absolute fluid-tightness of the chambers of the heat engine is obtained. By making the area of the movable wall **43** sufficiently great, it is possible, for small variations of temperature, to impart considerable forces to the rod **42**.

The example considered can form a thermostat for central heating installations; said thermostat, which is very sensitive, can act directly on the draught of the furnace of the boiler or on a cold and hot water mixing-valve.

Fig. 2 shows an application, according to the invention, of the heat engines of the kind indicated, to the control of an electric contact-breaker.

The group of the elements of the contact-breaker is arranged in one of the chambers of the engine, said group comprises a deformable resilient blade **1** which is fixed to a terminal **2** and can

oscillate between two contact studs 3 and 4 connected respectively to terminals 5 and 6 which are electrically insulated and are fluid-tightly fixed, as the terminal 2, on the wall 7 of the box 8. The second chamber of the engine is provided at 9 and is separated from the first chamber 8 by a deformable wall 10 which acts, by means of a central push rod 11, on the resilient blade 1 which is mounted in such a manner that, in the absence of any constraint, it touches the stud 4. The chamber 8 contains a saturant vapour, the generating liquid of which is advantageously a transformer oil in sufficient quantity to cover the studs 3 and 4 constantly. The chamber 9 contains a gas or a non-saturant vapour and the respective pressures in the chambers 8 and 9 may be so chosen that, for a temperature less than that at and beyond which the contact 1—4 is to be broken, the wall 10 is pressed against the end 13 of the box 8. The pressure in the chamber 9 being assumed to increase much faster than that in the chamber 8, the sudden break of the contact 1—4 with immediate closing of the contact at 1—3 will be obtained at and beyond a predetermined temperature, or the closing of this latter contact for a predetermined higher temperature.

In the embodiment shown in Fig. 3, the movable wall 10, which separates the two chambers 8 and 9 of the heat engine, is connected by a connecting rod 14 to a friction contact arm 15 which is pivoted at a fixed point 16 and which, for predetermined temperatures, touches the contact studs of a series 17 which is arranged in the box 8 and surrounded by a suitable atmosphere for preventing break sparks and for ensuring the preservation of the contacts (and such, for example, as carbon dioxide under a pressure of 50 to 60 kgs. per square centimeter). It is thus possible to control electric circuits for obtaining, through the intermediary of relays, any desired effects (remote control of temperatures for example). The connection with the contact studs 17 and the outside circuits is effected by means of terminals 18 which are electrically insulated and are fluid-tightly fixed on the end 19 of the box 8.

In the embodiment of Fig. 4, relating to an apparatus which can be used as a pressure gauge, or as a barometer and as an altimeter, a heat engine which is arranged as an automatic contact-breaker is utilised for keeping constant the temperature, which temperature is maintained by electric resistances, both of the gas contained in a manometric capsule 20 and of the gas in which said capsule is immersed and of which it is required to measure the pressure. As the temperature is constant, the variations of volume of the capsule 20 exactly express the variations of pressure of the gas it contains and which correspond to those of the surrounding gas. Said capsule may be constructed with a very thin and very flexible wall, the mechanical strength of which is negligible. The apparatus of the pressure gauge type thus constructed is free from all the drawbacks referred to above in connection with the known apparatus of the same type.

The heat engine has two chambers 21 and 22 with a common deformable wall 23 which acts on the movable blade 24 of a contact-breaker as already explained in connection with Fig. 3. Said contact-breaker controls the supply current of an electric heating resistance 25 which is in close contact with the wall 26 of the engine and the end 27 of the deformable walled manometric capsule 20 contained in a chamber 28 of good heat conductibility and, for example made of copper or of brass. The whole arrangement is placed in a heat insulating case advantageously formed by a Dewar's flask 29 which is closed by a plug 30 made of any appropriate heat insulating material. The chamber 28 is in communication with the atmosphere of which it is desired to measure the pressure, through a tube 31 and the rigid front face 32 of the capsule 20 is connected by a connecting rod 33 to a pointer 34 which is pivoted at 35 and of which the tip moves in front of any appropriate graduation.

In the example of Fig. 5, which is only a modification of construction of the apparatus shown in Fig. 4, the chamber 28, which contains the manometric capsule 20 and which is in permanent communication with the atmosphere of which it is desired to measure the pressure, is in direct contact by means of each of its ends, on the one hand with a saturant vapour chamber 21ª, and on the other hand with a second saturant vapour chamber 21 which forms one of the chambers of the heat engine having a contact-breaker. The same reference numerals designate the same members or the members which correspond with each other in the two Figures 4 and 5. The electric heating resistance 25 is arranged in close contact with the outer end of the chamber 21ª which communicates through tubes 36 and 37 respectively with the upper and lower parts of the chamber 21.

The saturant vapours and their generating liquids 66 being thus in communication from one chamber 21 to the other chamber 21ª, the temperature is absolutely the same in both chambers. Said temperature is kept constant between narrow limits by the action of the contact-breaker 24 which is actuated by the movable wall 23 of the heat engine.

Fig. 6 shows the application, to the construction of a mercury gravimeter, of the heat engine contact-breaker described in particular with reference to Fig. 2. The heat engine having a movable wall 48 and a contact 50 controls the supply of the heating resistance 51 which keeps the temperature constant of a gas enclosed in the fluid-tight chamber 52. Said chamber, together with the engine having a contact-breaker and the resistance 51, is arranged in a Dewar's flask 53 which is closed by a heat insulating plug 54. Two bulbs 55 and 56 are arranged inside the chamber 52 and connected together by a U-tube 57 which contains a column of mercury 58. The pressures of the gases contained in the bulbs 55 and 56 are different, their difference being expressed by the column of mercury of which the height is H. Said height H is proportional to the density of the mercury, to gravity and to the temperature of the bulbs 55 and 56. As said temperature is constant, the density of the mercury is also constant and H then expresses the value of gravity. Terminals 59, 60, 61 enable electric circuits to be closed by the column of mercury, for actuating relays in order to obtain controlling or other effects. Such an apparatus mounted on an aeroplane and suspended by its support on a joint of the Cardan type placed above its centre of gravity can be utilised as a turning indicator on board aeroplanes, centrifugal force acting in that case with gravity. The aforementioned electric circuits can in that case be utilised for actuating any indicating or controlling apparatus.

JEAN-LÉON REUTTER.

PUBLISHED

JUNE 15, 1943.

BY A. P. C.

JEAN-LÉON REUTTER

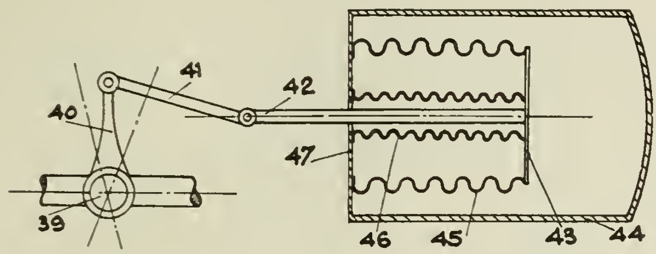
HEAT ENGINES OPERATING WITH TWO DIFFERENT FLUIDS WHICH ARE SUBJECTED TO THE SAME TEMPERATURES AND NOVEL APPLICATIONS OF SAID ENGINES

Filed Jan. 28, 1938

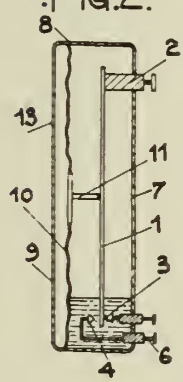
Serial No. 187,354

2 Sheets—Sheet 1

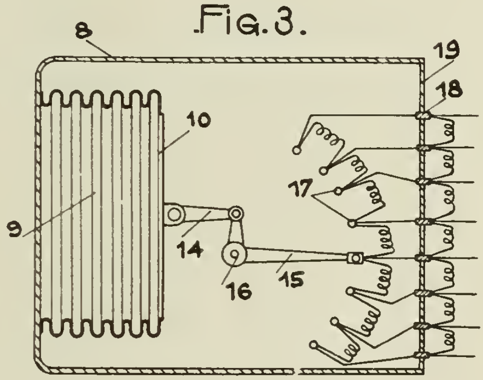
.FIG.1.



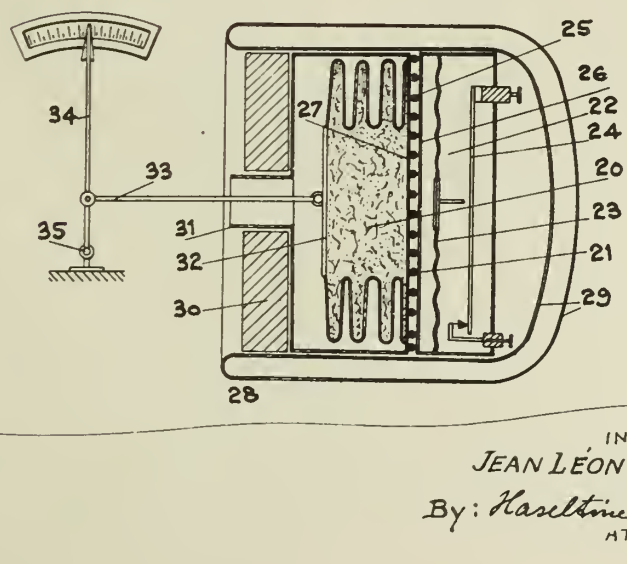
.FIG.2.



.FIG.3.



.FIG.4.



INVENTOR
JEAN LÉON REUTTER
By: Haseltine, Lake & Co.
ATTORNEYS

PUBLISHED

JUNE 15, 1943.

BY A. P. C.

JEAN-LÉON REUTTER

HEAT ENGINES OPERATING WITH TWO DIFFERENT FLUIDS WHICH ARE SUBJECTED TO THE SAME TEMPERATURES AND NOVEL APPLICATIONS OF SAID ENGINES

Filed Jan. 28, 1938

Serial No. 187,354

2 Sheets--Sheet 2

FIG. 5.

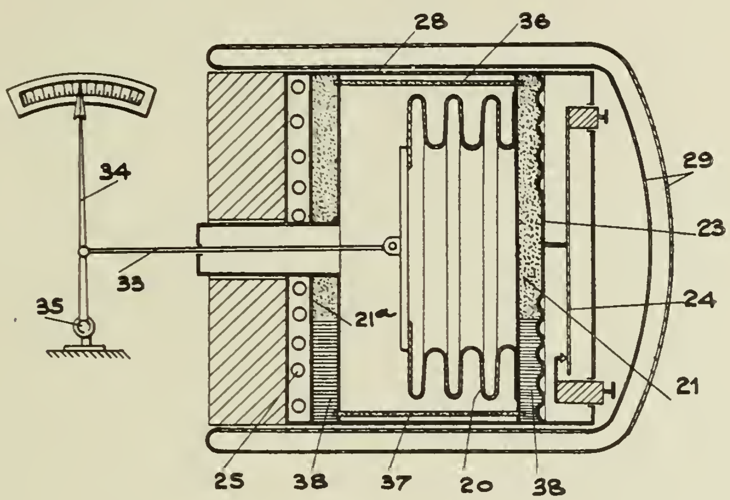
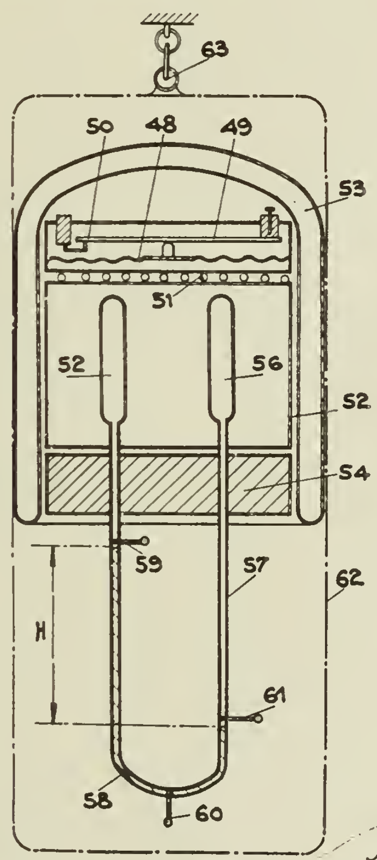


FIG. 6.



INVENTOR
JEAN LÉON REUTTER
By: Haseltine, Lake & Co.
ATTORNEYS

Published June 15, 1943 Serial No. 188,058

ALIEN PROPERTY CUSTODIAN

PREPARATIONS FOR PROTECTION FROM INSECTS

Eduard Dörr and Erich Goth, Wuppertal-Elberfeld, Germany; vested in the Alien Property Custodian

No Drawing. Application filed February 1, 1938

This invention relates to materials for repelling insects, more particularly it relates to a combination of materials displaying in themselves a certain insect-repelling action with water-soluble alkaline-earth metal salts.

The use of various organic substances especially substances having a strong odor for warding off insects is known. The efficacy of these substances, however, is rather unsatisfactory and in particular does not last long. This disadvantage is, for instance, to be observed with coumarine and its substitution products.

In accordance with the present invention such organic substances which already have a certain insect repelling action and more particularly coumarine and its substitution products are combined with water-soluble alkaline-earth metal salts whereby the insect-repellent action is remarkably prolonged.

Substitution products of coumarine are for instance those deriving from coumarine substituted either in the benzene or in the pyrone ring system. Such substituents for istance halogen atoms including fluorine atoms and alkyl and aryl groups such as the ethyl- or methyl-group may for instance stand in 3- or 4-position. The same substituents as well as for instance hydroxyl groups which may be esterified or etherified may be present in the benzene nucleus, particularly in the 6- and/or 7-position. The CO-group of the pyrone ring system may be replaced by the CS-group.

Suitable insect repelling compounds in the preparations according to our invention are besides coumarine for instance 3-methyl-coumarine, 3-ethyl-coumarine, 4-methyl-coumarine, 4-ethyl- or isopropyl-coumarine, 4-bromo-, chloro- or fluoro-coumarine as well as 3-chloro-, 3-phenyl- or 4-phenyl-coumarine. Also derivatives of para-hydroxy-ortho-coumaric acid such as umbelliferone or β-methylumbelliferone may be advantageously used. Suitable substitution products of coumarine are for instance disclosed in U. S. Patent No. 1,995,247 to Berthold Günther Haring.

As watersoluble salts of the alkaline-earth metals, for instance halogenides, rhodanides, nitrates come into consideration. Suitable compounds are for instance strontium bromide, calcium chloride, calcium bromide, magnesium sulfate, magnesium chloride and calcium rhodanide. Of course, only those watersoluble salts of the alkaline-earth metals can be used which are innoxious to the human organism, especially the human skin.

The quantity and nature of the single constituents of our preparations may be varied within wide limits. They are preferably employed in suitable admixture, for instance, with the addition of extending agents, such as solvents or diluents emulsifying, dispersing or thickening agents, so that the preparation may be used in the form of a solution, emulsion, paste or powder. As extending agents the following substances may be mentioned by way of example: ethyl alcohol, aqueous ethyl alcohol, isopropanol, octodecyl alcohol, glycerine, kieselgur, talcum, plaster of Paris, paraffin, woolfat and other ointment bases such as eucerine, petroleum jelly, wax and starch. Further perfuming agents and cosmetic agents may be added.

For commercial reasons we generally prefer using coumarine, as the insect repellent constituent of our preparations; as watersoluble alkaline-earth metal salts the halogenides particularly the bromides and chlorides are used. As extender advantageously an aliphatic alcohol such as ethyl alcohol or octodecyl alcohol is present. The total amount of water in our preparations should preferably not substantially exceed 15%.

The invention is further illustrated by the following examples without, however, being restricted thereto, the parts being by weight:

Example 1

	Parts
Coumarine	10
Calcium chloride	10
96% alcohol	80

yield a solution for warding off insects.

Example 2

	Parts
Clove oil	5
Coumarine	3
Strontium bromide	8
Calcium chloride	6
85% alcohol	78

yield a solution for warding off insects.

Example 3

	Parts
Coumarine	9
Calcium chloride	5.4
Magnesium chloride	1.7
96% alcohol	75
Water	9

yield a solution for warding off insects.

Example 4

	Parts
96% alcohol	15
Octodecyl alcohol	15
Coumarine	5
Calcium chloride	5

are melted together on the water bath while stirring and rapidly cooled. In this manner a paste is obtained which on application is suitable for warding off insects.

Example 5

	Parts
Coumarine	10
Calcium thiocyanate	6.8
96% alcohol	90

Instead of calcium thiocyanate for instance calcium nitrate or magnesium chloride may be used in equimolar amounts.

Example 6

	Parts
Coumarine fluoride	10
Calcium chloride	6
Magnesium chloride	4
Water	8
96% alcohol	85

Example 7

	Parts
3-phenyl coumarine	2
Calcium chloride	1
96% alcohol	234

Example 8

	Parts
Umbelliferone	2
Calcium chloride	1.38
96% alcohol	27

Example 9

	Parts
β-methylumbelliferone	2
Calcium chloride	1.25
96% alcohol	54

Example 10

	Parts
4-methyl coumarine	15
Calcium chloride	11
96% alcohol	135

As compared with preparations containing no watersoluble alkaline-earth metal salts preparations of the kind specified exhibit a much more prolonged action in warding off insects. The increased efficacy of these preparations as compared with preparations containing no water-soluble alkaline-earth metal salts in most cases amounts to the two- or three-fold or even much higher value. This surprising increase of the efficacy is most likely due to the formation of double compounds between the organic active compounds and the alkaline-earth metals salts in the preparation.

This increase of the efficacy is illustrated by the following results of comparative tests:—

A preparation consisting of 10 parts of fluorocoumarine and 90 parts of a 96 per cent alcohol displays a sufficient insect repellent action still after 3 hours. Already after about 5 hours and a half the insect repellent action has disappeared. When using the preparation according to example 6 a sufficient insect repellent action is still observed after 9 hours.

A preparation consisting of 2 parts of phenyl coumarine and 234 parts of 96 per cent alcohol has lost its insect repellent action after 1 hour. To the contrary the preparation described in example 7 has preserved its full action still after 4 hours and even after 7 hours still displays a pronounced insect repellent action.

The tests were performed by putting an arm covered with the insect repellent preparation to be investigated into a small cage in which 1000–1500 mosquitos were kept. If within 5 minutes no mosquitos stinged the insect repellent action of the preparation was regarded as being sufficient. If within this time more than 5 mosquitos stinged the preparation was considered to be effectless.

This application is a continuation-in-part of our co-pending application Serial No. 119,364, filed January 6, 1937.

EDUARD DÖRR.
ERICH GOTH.

Published June 15, 1943

Serial No. 188,059

ALIEN PROPERTY CUSTODIAN

PREPARATIONS FOR PROTECTION FROM INSECTS

Eduard Dörr and Erich Goth, Wuppertal-Elberfeld, Germany; vested in the Alien Property Custodian

No Drawing. Application filed February 1, 1938

This invention relates to materials for repelling insects, more particularly it relates to a combination of materials displaying in themselves a certain insect-repelling action with water-soluble alkaline-earth metal salts.

The use of various organic substances especially substances having a strong odor for warding off insects is known. The efficacy of these substances, however, is rather unsatisfactory and in particular does not last long. This disadvantage is, for instance, to be observed with cinnamic alcohol and its derivatives.

In accordance with the present invention such organic substances which already have a certain insect repelling action and more particularly cinnamic alcohol and its derivatives are combined with water-soluble alkaline-earth metal salts whereby the insect-repellent action is remarkably prolonged.

Suitable derivatives of cinnamic alcohol are particularly its esters and ethers having insect repellent properties. Compounds of this kind are by way of example the esters of aliphatic and aromatic carboxylic acids such as cinnamyl acetate-, propionate, -methoxy acetate, -isobutyrate and cinnamyl benzoate. Also for instance cinnamyl -ethyl ether or the corresponding methyl ether may be employed.

As water-soluble salts of the alkaline-earth metals, for instance halogenides, rhodanides, nitrates come into consideration. Suitable compounds are for instance strontium bromide, calcium chloride, calcium bromide, magnesium sulfate, magnesium chloride and calcium rhodanide. Of course, only those watersoluble salts of the alkaline-earth metals can be used which are innoxious to the human organism, especially the human skin.

The quantity and nature of the single constituents of our preparations may be varied within wide limits. They are preferably employed in suitable admixture, for instance, with the addition of extending agents, such as solvents or diluents emulsifying, dispersing or thickening agents, so that the preparation may be used in the form of a solution, emulsion, paste or powder. As extending agents the following substances may be mentioned by way of example: ethyl alcohol, aqueous ethyl alcohol, isopropanol, octodecyl alcohol, glycerine, kieselgur, talcum, plaster of Paris, paraffin, woolfat and other ointment bases such as eucerine, petroleum jelly, wax and starch. Further perfuming agents and cosmetic agents may be added.

For commercial reasons we generally prefer using cinnamic alcohol as the insect repellent constituent of our preparations; as watersoluble alkaline-earth metals salts the halogenides particularly the bromides and chlorides are used. As extender advantageously an aliphatic alcohol such as ethyl alcohol or octodecyl alcohol is present. The total amount of water in our preparations should preferably not substantially exceed 15%.

The invention is further illustrated by the following examples without, however, being restricted thereto, the parts being by weight:—

Example 1

	Parts
Coumarin	10
Calcium chloride	10
96% alcohol	80

yield a solution for warding off insects.

Example 2

	Parts
Cinnamyl isobutyrate	10
Calcium chloride	5.45
96% alcohol	90

yield a solution for warding off insects.

Example 3

	Parts
Cinnamyl propionate	10
Calcium chloride	5.85
96% alcohol	90

yield a solution for warding off insects.

Example 4

	Parts
Cinnamyl methoxyacetate	2
Calcium chloride	1.08
96% alcohol	18

yield a solution for warding off insects.

Example 5

	Parts
Cinnamyl acetate	13.1
Calcium chloride	10.0
96% alcohol	87.0

yield a solution for warding off insects.

Instead of calcium chloride also for instance calcium bromide, calciumisothiocyanate, calcium nitrate or magnesium chloride or magnesium bromide may be used.

As compared with preparations containing no water-soluble alkaline-earth metal salts preparations of the kind specified exhibit a much more prolonged action in warding off insects. The increased efficacy of these preparations as com-

pared with preparations containing no water-soluble alkaline-earth metal salts in most cases amounts to the two- or three-fold or even much higher value. This surprising increase of the efficacy is most likely due to the formation of double compounds between the organic active compounds and the alkaline-earth metal salts in the preparation.

This increase of the efficacy is illustrated by the following results of comparative tests:—

A preparation consisting of 13.1 parts of cinnamyl acetate and 87 parts of a 96 per cent alcohol displays a sufficient insect repellent action still after one hour. Already after about 2 hours the insect repellent action has disappeared. When using the preparation according to example 5 a sufficient insect repellent action is still observed after 9 hours.

A preparation consisting of 2 parts of cinnamyl methoxyacetate and 18 parts of a 96 per cent alcohol has lost its insect repellent action after 1 hour. To the contrary the preparation described in example 4 has preserved its full action still after 3 hours and even after 4 hours still displays a pronounced insect repellent action.

The tests were performed by putting an arm covered with the insect repellent preparation to be investigated into a small cage in which 1000–1500 mosquitos were kept. If within 5 minutes no mosquitos stinged the insect repellent action of the preparation was regarded as being sufficient. If within this time more than 5 mosquitos stinged the preparation was considered to be effectless.

This application is a continuation-in-part of our co-pending application Ser. No. 119,364, filed January 6, 1937.

EDUARD DÖRR.
ERICH GOTH.

Published June 15, 1943 Serial No. 190,868

ALIEN PROPERTY CUSTODIAN

TUBULAR RIVETS AND LIKE HOLLOW ELEMENTS AND TO METHODS OF FIXING THE SAME

Jacques Francois Gabriel Chobert, Saint-Etienne, France; vested in the Alien Property Custodian

Application filed February 16, 1938

The present invention relates to tubular rivets, unions and like hollow elements and more especially to those adapted to be secured by being upset by a headed mandrel which is forced through the interior thereof to perform the upsetting operation and also to methods of fixing such elements.

Hollow elements of this type having one or more internal collars or annular beads are known but are expensive and difficult to manufacture and are not easily gauged to ensure accuracy of dimensions. An object of the present invention is to provide hollow elements of this type which are more easily manufactured, are less costly to produce and are more easily gauged.

According to the present invention the internal bore of the hollow element is smooth and is of substantially uniform diameter. In one form in accordance with this invention the shank of the hollow element is provided on its exterior with one or more annular beads or collars which, when the element is upset by the mandrel, are forced outwards to secure the element in position.

In another form also in accordance with the present invention both the interior and exterior of the shank of the hollow element are of substantially uniform diameter. The mandrel is of greater extreme diameter than the internal diameter of the element and in performing the upsetting operation the body of the element is expanded to engage the member or members to which the element is to be secured.

The uniform internal bore of the hollow elements according to the present invention facilitates manufacture of the elements. The smooth bore left after the upsetting operation facilitates the closing of the rivet by a plug or the like and offers little frictional resistance to flow of liquids.

The formation of external collars or annular beads on the hollow element is considerably less expensive than the formation of such collars on the interior and such exterior collars can be more accurately machined and are more easily gauged to ensure accuracy.

In the alternative form of hollow element the external collars are omitted and the shank of the element is smooth and is of uniform diameter, the walls being slightly increased in thickness to provide extra metal for securing the element.

The present invention will be more fully described hereafter with reference to the drawings which show by way of example various embodiments thereof as applied to tubular rivets, unions and to the securing of tubes to plates.

In the drawings:

Figs. 1 to 10 show examples of the use of the first form of hollow element in accordance with the invention having external collars, while Figs. 11 to 19 show examples of the use of the second form having a smooth exterior.

Figs. 1 to 3 are sectional views showing tubular rivets with different shapes of head.

Fig. 4 shows the application of the form of rivet of Figs. 2 and 3 to securing together plates which have become slightly separated.

Figs. 5 and 6 are sectional views showing unions for fixing to tubes and to plates respectively.

Figs. 7 to 10 are sectional views showing the use of various forms of this type of rivet for securing tubes to plates.

Figs. 11 and 12 are sectional views showing successive stages in the upsetting of a tubular rivet of the second type.

Figs. 13 and 14 are similar views showing two forms of headless rivet used to draw two plates together.

Figs. 15 and. 16 are sectional views showing unions of the second type.

Figs. 17, 18 and 19 show three ways of securing a tube in a plate using the second type of rivet.

One of the forms of rivet with an external collar is shown in Fig. 1, in which 1 and 2 are the plates to be secured together by the rivet which is inserted in a hole 3 therein; 4 is the conical head of the upsetting mandrel the stem 5 of which may be gripped in the jaws of the riveting machine to displace it in the direction of the arrow; 6 is the nose of the riveting machine, which is pressed against the head 8 of the rivet. The rivet 7 has a head 8, a cylindrical shank 7, and an external collar 9.

The diameter of the head of the mandrel is greater than the internal diameter of the rivet and is preferably intermediate between the internal and external diameter thereof and is so designed that the upset rivet completely fills the hole 3 in the plates 1 and 2.

When the mandrel is drawn through the rivet, it first expands the collar 9, which grips the under side of the plate 2, all round the hole 3. The mandrel then expands the shank of the rivet to fill completely the free space between the walls of the hole 3 and the shank of the rivet.

When the mandrel has passed completely through the rivet, the plates are firmly connected together.

The head of the rivet may be of any convenient shape, for example chamfered as shown in Fig. 1.

Fig. 2 shows an alternative form of rivet in which the head 8 of the type of rivet shown in Fig. 1 is replaced by an upper expansion collar 9^1. This symmetrical design of the rivet facilitates production, and enables the rivets to be mounted automatically on the mandrels of the riveting machines, since they can be threaded thereon either way up. In passing through the rivet, said mandrel first expands the lower ring 9, which grips the under-side to the plate 2, then expands the shank 7, which completely fills the hole 3, and finally expands the upper collar 9^1 which grips the plate 1 and forms the head of the rivet.

Fig. 3 shows a rivet of the same type, the upper plate 1 being countersunk at 10, to receive the upper expansion collar 9^1 when the later is expanded. With this form, no part of the rivet projects above the surface of the plate 1 after upsetting. Should it also be desirable for the rivet not to project below the plate 2, the latter may be similarly countersunk.

The form of rivet shown in Figs. 2 and 3 may in addition to its normal applications be used to secure together plates which have become slightly separated, this not being possible with tubular rivets of known construction having a preformed head. An example of this is shown in Fig. 4 in which the lower plate 2 has become slightly separated from the upper plate 1.

For this purpose it is necessary to employ a special fixing machine with a two-fold movement. The rivet 7 is placed on the mandrel 5 of a machine having two work-positioning noses, the inner one, 11, being adapted to be extended beyond the outer nose 6 by a distance exceeding the space that may exist between the plates to be drawn and secured together. The assembly is then passed through the hole 3 in the plates so that the lower collar 9 of the rivet 7 projects below the lower plate 2, it is necessary for this purpose that the greatest external diameter of the rivet should be less than the diameter of the hole 3.

When the mandrel is drawn upward by the riveting machine the upper end of the rivet butts against the inner nose 11 of the machine allowing the head 4 of the mandrel to expand the lower collar 9, the external diameter of which is increased and becomes greater than that of the hole 3 provided in the plates.

The inner nose 11 of the riveting machine is then released, and retracts within the outer nose 6 which is drawn into contact with the plate 1. The mandrel draws up the rivet but, since the lower collar 9 has been expanded, said collar can no longer pass through the hole 3 in the plate 2, and consequently raises said plate and presses it against the plate 1.

When the two plates are pressed together the mandrel is obliged to pass through the rivet, expanding the shank 7 to fill the hole 3 in the plates and then expanding the upper collar 9^1 thereby causing it to grip the upper plate 1.

If desired the upper and/or the lower surfaces of the plates may be chamfered as indicated in Fig. 3.

The application of this invention to a union is shown in Fig. 5.

The union 12 may have a threaded portion which projects beyond the tube 13 to which it is to be secured, and has a cylindrical portion which enters the tube and is provided with one or more exterior expansion collars.

The union shown in Fig. 5 has two expansion collars 9 and 9^1 and a short conical section 9^2. The tube 13 is inserted in a reinforcing ring 14 provided with three annular recesses 15, 15^1 and 15^2 corresponding in position with the collars 9, 9^1 and 9^2 respectively.

The head 4 of the upsetting mandrel, has a diameter greater than the internal diameter of the cylindrical shank of the union, and, in passing through the union expands, firstly, the collar 9 (which forces the tube into the recess 15), then the cylindrical portion and a second collar 9^1 (which forces the tube into the groove 15^1) and the remaining cylindrical portion, and finally the conical section 9^2 which forces the tube 13 into the corresponding recess 15^2 in the ring 14.

The expansion collars may be of any desired number and shape, and the same applies to the facing annular recesses provided in the ring 14, These unions may also be fixed without any exterior ring.

Fig. 6 represents a union 16 with an external expansion collar 9 for fixture to a plate 1.

During the upsetting operation the union 16 is held in position by the nose 6 of the riveting machine. The mandrel 4, in passing through the union 16, first expands the collar 9 (which grips the under side of the plate 1), and then expands the cylindrical shank of the union to fill the hole in the plate 1.

When the mandrel has passed completely through, the shank 16 makes a perfectly tight joint with the plate 1.

This type of rivet having external expansion collars may be used to secure tubes to plates as indicated hereafter.

Fig. 7 shows an example of this method of fixing, 13 indicating the tube to be secured to a plate 1. A headed rivet 7, with an external expansion collar 9 is inserted in the tube.

The head of the rivet is pressed against the plate 1 by the nose 6 of the fixing machine. In passing through the rivet, the mandrel, the head of which has a diameter greater than the internal diameter of the shank of the rivet, expands the collar 9, which deforms the tube and causes it to engage the lower surface of the plate 1.

The mandrel then expands the cylindrical shank 7 of the rivet, pressing the outer face of the tube against the wall of the hole in the plate 1.

Fig. 8 shows another example in which the expansion collar 9 of the rivet occupies a position within the thickness of the plate 1. The hole in which the tube 13 is to be secured is provided with an annular recess 15 on a level with the collar 9 of the rivet, so that, in passing through the rivet, the mandrel expands the whole of the latter, and the collar 9 forces out the tube to fill the free space in the recess 15. The tube 13 is more firmly secured than in the case of the preceding example.

Fig. 9 shows a further example in which the rivet is provided with two expansion collars 9 and 9^1 and with a short conical section 9^2.

In passing through the rivet, the mandrel expands the first collar 9, which distends the tube 13 against the under side of the plate 1. It next expands the cylindrical portion, and then the second collar 9^1, which forces the tube into an annular recess 15 provided in the hole of the plate 1. Continuing its stroke, the mandrel expands the cylindrical portion, and then the conical section 9^2, which forces the end of the tube into a corresponding recess 15^1 provided in the upper face of the plate. The tube is thus secured very firmly to the plate.

The bore of the rivet may be relieved as indicated at the upper end to prevent any metal drawn up by the passage of the mandrel from protruding beyond the head of the rivet.

Fig. 10 shows an example in which the rivet 7 employed to secure the tube 13 is symmetrical and headless being provided with two expansion collars 9 and 9[1]. The manner in which the tube is secured, will be easily understood from the description of the preceding examples.

To give increased strength a third collar might be arranged between the collars 9 and 9[1] to force the tube into an annular recess provided about midway of the thickness of the end plate 1. In the embodiment shown, the upper end of the hole is chamfered as indicated at 15 to receive the upper expansion collar 9[1].

All the rivets with outside expansion rings have the disadvantage that the rivets must be arranged to correspond exactly with the thicknesses of the plate or plates to be secured.

The second form of hollow element according to the present invention differs from the first in that the external expansion collars of the first form are omitted This form has an advantage over the first form that a given element can be used for a variety of thicknesses of plate as there is no necessity for exact correspondence between the axial dimensions of the rivet and the thickness of the plate or plates

Fig. 11 shows an example of the second type of hollow element in which a rivet 7 is a simple cylindrical tube provided with a head 8 which may be of any convenient shape.

The internal diameter and the thickness of the walls of the rivet are dependent on the amount of the rivet which is to be expanded outwards to secure it in position, the external diameter normally being generally the same as that of the hole in which the rivet is to be secured. The diameter of the head of the upsetting mandrel is equal to the final internal diameter of the rivet when upset and is preferably intermediate between the external and internal diameters of the shank of the rivet.

The nose 6 of the riveting machine presses the head of the rivet firmly on to the plate 1. When drawn through the rivet, the mandrel easily expands that part of the rivet which is below the lower plate 2, causing an annular bulge 17 (Fig. 12). The mandrel then expands the shank of the rivet pressing the walls outwards against the walls of the hole 3 and causing an upward flow of the metal. The head of the rivet is recessed at 18 (Fig. 11), to allow the upward displacement of the metal; and the nose 6 of the machine is provided with an annular recess 19 into which the metal can also flow.

It will be evident that a rivet of this type can serve to secure various thicknesses of plate, the height of the annular bulge 17 simply varying according to the thickness to be gripped.

This rivet is extremely easy to produce by machining or pressing, and is also very easily gauged to ensure accuracy.

Fig. 13 shows another example of the invention in which the rivet is a simple tubular member, the head as well as the tail being deformed in the upsetting operation to secure the rivet.

In order to fix this form of rivet for the purpose of securing together plates which have become separated it is necessary, as in the case of the rivet shown in Fig. 4, to employ a machine with double concentric noses 6 and 11.

The rivet 7 is threaded on the mandrel 4, the inner nose 11 of the machine bearing against the upper end of the rivet and the assembly is then inserted into the hole in the plate 1, so that the lower portion of the rivet projects below the plate 2. The mandrel then expands the portion of the rivet which extends below the plate 2.

When a length of 1–2 millimetres of this portion of the rivet has been expanded, the inner nose 11 is released and is retracted within the outer nose 6.

On continuing to ascend, the mandrel draws upward the rivet 7 and the plate 2, which latter is pressed against the plate 1. When the two plates are in contact the noses 6 and 11 of the riveting machine bear against the upper plate 1 and the rivet respectively; the mandrel is then drawn completely through the rivet 7 and expands it, thus securing it in position.

Fig. 14 shows a modified arrangement in which the upper plate 1 is countersunk as indicated at 10 to receive the expanded head of the rivet.

Fig. 15 shows this form of the invention as applied to a union. The union 12 is inserted in a tube 13 which is surrounded by a reinforcing ring 14 provided with annular recesses 15, 15[1], 15[2].

In passing through the cylindrical portion 12 of the union, the head of the upsetting mandrel tends to expand the union and tube against the reinforcing ring and since the head is of greater diameter than the bore, it displaces some of the metal of the union upwards in front of it, thus forcing the metal of the tube outwards below said ring and also into the annular recesses 15, 15[1] and 15[2] provided in said ring.

The annular recesses may be of any number and shape. The interior of the union fixed in this manner is exceedingly smooth.

Fig. 16 shows a hollow union 16 to be fixed in a plate 1. As in the other case, the head of the mandrel has a diameter intermediate between the internal and external diameters of that portion of the union which is enclosed in the plate 1.

The union 16 is held in position on the plate 1 by the nose 6 of the riveting machine. In passing through the union 16, the head 4 of the mandrel expands the cylindrical portion, causing the metal to bear against the lower surface of the plate 1. The mandrel then expands the portion embedded in the thickness of the plate 1, and presses it into intimate contact with the plate.

Unions of this kind are far more quickly and economically produced than in the case of unions provided with an expansion ring, such as shown in Fig. 6. Moreover, unions and like hollow bodies of this type may be fixed on plates of widely differing thickness.

This type of cylindrical rivet expanded by the passage of a mandrel having an enlarged head, the diameter of which is intermediate between the internal and external diameters of the rivet may also be used to secure tubes to plates.

Figs. 17 and 18 show examples of this method of securing a tube 13 with a headed tubular rivet 7.

The rivet 7 is inserted in the tube 13 which, in turn, is inserted in a hole in a plate 1.

In the embodiment shown in Fig. 17, the hole in the plate is smooth, whilst in that shown in Fig. 18 the hole is provided with two annular recesses in which the tube becomes embedded under the outward thrust of the metal of the rivet during the upsetting operation.

The head of the rivet is preferably countersunk as indicated at 18, to accommodate the

metal forced upwards by the head of the mandrel during the upsetting operation.

In passing through the rivet 7, the mandrel expands the latter, causing the tube to expand and engage the under-side of the plate 1.

The mandrel then expands the tube outwards against the walls of the hole in the plate. In the case of the arrangement shown in Fig. 18, the metal of the tube is also forced into the annular recesses provided in the interior of the hole in the plate.

Fig. 19 shows an alternative arrangement in which the rivet is headless and consists of a cylindrical member. This rivet offers all the advantages of the plate rivets shown in Figs. 13 and 14.

From the foregoing examples, it will be readily evident how this rivet may be used to secure the tube 13 in the end plate 1, when the rivet is upset the tube is secured to the end plate by engagement with the lower side of the plate and also with the recesses in the hole.

The shape of the recesses in the hole and also their number may be modified as desired, a tube may even be secured in a plain hole in the plate by a rivet of this type but this provides a less secure fastening than the arrangements above described.

JACQUES FRANCOIS
GABRIEL CHOBERT.

PUBLISHED

JUNE 15, 1943.

BY A. P. C.

J. F. G. CHOBERT
TUBULAR RIVETS AND LIKE HOLLOW ELEMENTS
AND TO METHODS OF FIXING THE SAME
Filed Feb. 16, 1938

Serial No.
190,868

2 Sheets-Sheet 1

Fig. 1.

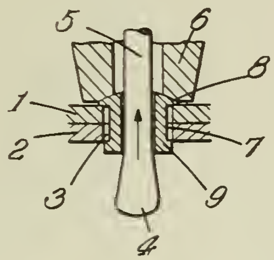


Fig. 2.

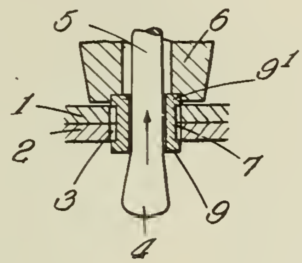


Fig. 3.

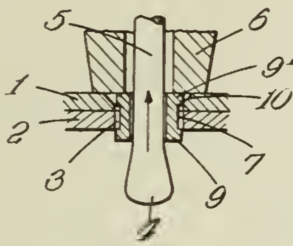


Fig. 4.

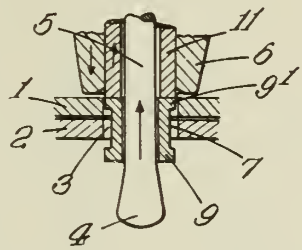


Fig. 5.

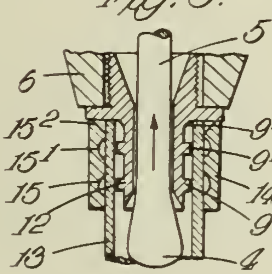


Fig. 6.

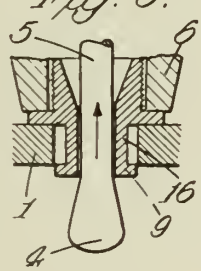


Fig. 7.

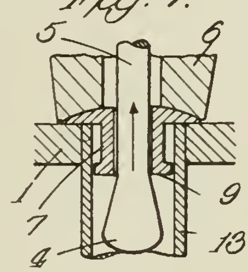


Fig. 8.

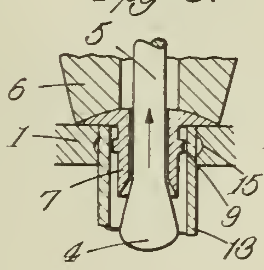


Fig. 9

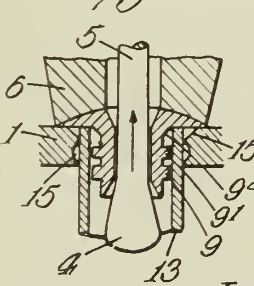
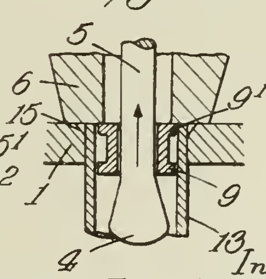


Fig. 10.



Inventor
Jacques F. G. Chobert
by Wilkinson & Mawhinney
Attorneys.

PUBLISHED

JUNE 15, 1943.

BY A. P. C.

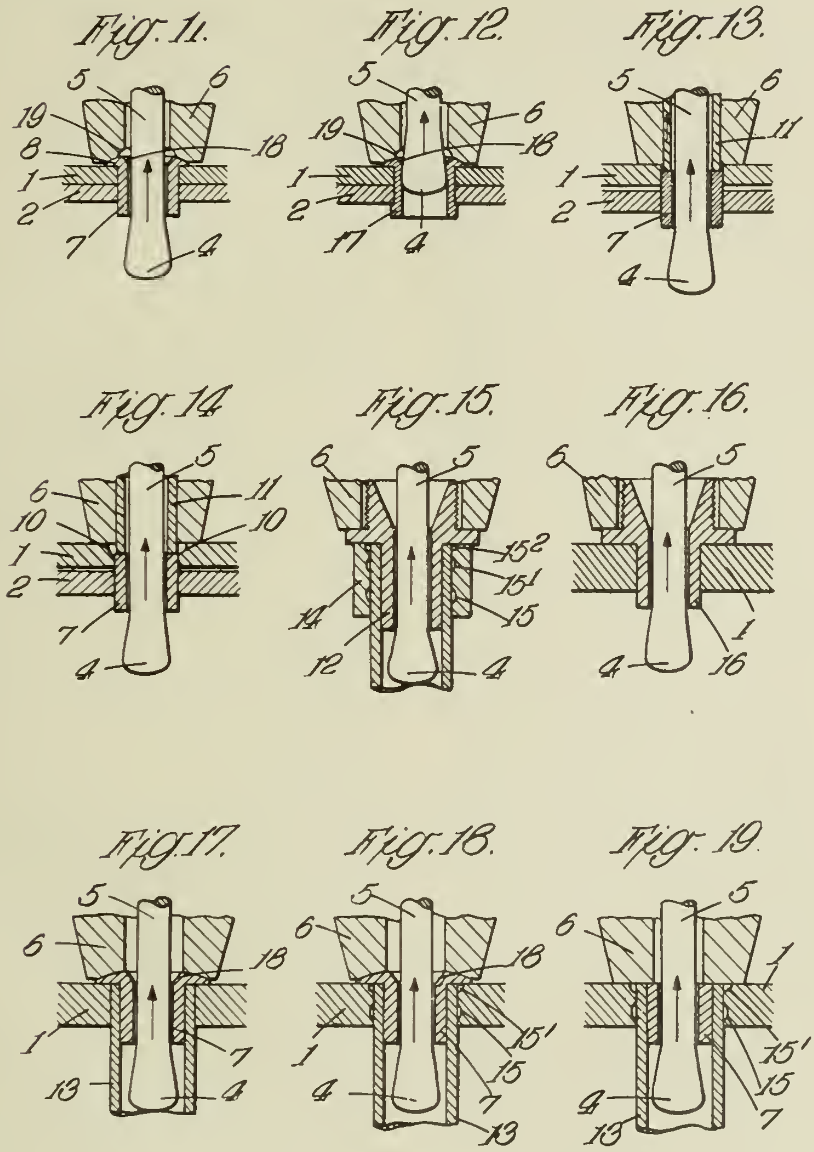
J. F. G. CHOBERT

TUBULAR RIVETS AND LIKE HOLLOW ELEMENTS
AND TO METHODS OF FIXING THE SAME

Filed Feb. 16, 1938

Serial No.
190,868

2 Sheets-Sheet 2



Canceled Oct 25, 19[illegible]

Inventor
Jacques F. G. Chobert
by Wilkinson & Mawhinney
Attorneys.

Published June 15, 1943 Serial No. 197,895

ALIEN PROPERTY CUSTODIAN

BLEACHING TEXTILE FIBRE

Ehrhart Franz, Berlin-Frohnau, Germany; vested in the Alien Property Custodian

No Drawing. Application filed March 24, 1938

This invention concerns the bleaching of textile fibre and more particularly a continuous bleaching process, this application representing a continuation of Serial No. 712,809, an application filed by the applicant herein under date of February 23rd 1934 under the heading "Continuous Bleaching Process" and of Patent No. 2,110,649, dated March 8th 1938, which has been issued on said patent application.

As a suitable bleaching agent, hydrogen peroxide, comes into question, or such preparations, which rely on the presence of hydrogen peroxide in watery solution for the bleaching action. According to this invention such bleaching agent may include, above all, percarbonate, caro's acids, organic and inorganic sulfomonoperacids, perphosphoric acids and the corresponding salts of these acids,—with exception of perborate and persulfate, which are not particularly suited for the instant objects. Goods or materials suited for bleaching by the instant process are textile fibre, be it of animal, plant, synthetic or mixed origin.

It is a particular object of this invention to carry out the bleaching in a continuous process. Continuous processes are known in other arts e. g. in dyeing, where either the treatment liquor, i. e. the solution serving for treatment, or the material to be treated is continuously moved. In a preferred exercise of the instant invention both methods are used, i. e. the material to be bleached is moved through the moving bleach. The bleaching agent, which has been used, is continuously regenerated or replaced, such replacement being effected at a point of the moving bleach, where no bleaching action takes place. Other ingredients used in the bleach are similarly replenished, when they are used up or are otherwise lost.

In continuous processes of other arts the chemicals may readily be adjusted in conformity with accompanying operations, and the solution finding use in such processes may be made and will remain more or less strong in accordance with the reaction thereby to be effected. By way of contrast the concentration of a bleach, in particular of a bleach of the type herein concerned, cannot be adjusted at random, because it is very little stable, spends itself and is, more particularly, subject to decomposition by reason of being moved or by reason of contact with and friction upon the surface of the material or goods to be bleached. Direct or indirect agitation of the bleach causes the loss of oxygen, i. e. oxygen is liberated from the hydrogen peroxide, and escapes to the atmosphere without having been put to bleaching use.

It is a particular object of this invention to overcome the uncertainty resulting from the changing concentration of a bleach by reducing the oxygen losses.

Such object is obtained, in part, by effecting a full, quick and intensive contact of the material to be bleached with the bleach. If the procedure is thus expedited, it may be carried through at a predetermined concentration of the bleach without the danger of undue and uncertain local fluctuation of such concentration.

The said object is further enhanced by dispensing with the use of carrier means, so far as a transportation through the bleach is concerned. Not only do such carriers agitate and therefore unduly decompose the bleach, but they also interfere with free and even contacting of the bleach with the material to be bleached, and they delay or may even prevent contact of all parts of the material with the bleach.

The instant invention renders the use of such carriers unnecessary because the goods are strung loosely or pieced together in band fashion for instance as a continuous or endless chain. Such a band or chain supports itself, while it depends into and is guided through the bleach. In connection with rayon and the like the squirted filament or bunches thereof may thus be directly run through a bleaching operation. In such a continuous "run" of the material through the bleach a fibre rapidly changes contact with the particles of the bleach at all times, thus assuring a bleaching treatment of like concentration for all parts of the material to be bleached.

An added improvement and acceleration of the bleaching process is further effected by moving the material to be bleached and the bleach contrary to each other, preferably at a 180° angle between the respective directions of movement. This makes it possible, that comparatively small quantities of the bleaching agent and bleach may be used, thus effecting a saving not only in bleaching material, but also in respect to a wear of the fibre of the material to be bleached. The new or newly conditioned bleach enters the bleaching vessel at a point, where the material to be bleached passes from said vessel after having passed therethrough. Thus the fresh bleaching solution is brought into contact with such portions of the material to be bleached, which could not be previously bleached by the exhausted or partly exhausted parts of the bleach. It is of course more effective to put new bleach primarily into use where an exhausted bleach fails.

On the other hand the material enters upon

the bleach, where the bleach has already been used and has been exhausted in part by bleaching activities. There the bleach is called upon to remove from the material to be bleached the more readily removable stains or portions of stains, the bleach being still strong enough for such substantially preliminary activities.

When the course of bleaching procedure is planned and directed in the foregoing manner, a bleaching process may be successfully carried through, although the bleach used is very low in concentration. Under normal circumstances, and as a matter of fact for a plurality of materials to be bleached, a peroxide concentration of 0.5% was found to be fully sufficient, which is indeed a very low concentration. At such a dilute phase a bleach yields very little oxygen to the atmosphere, since weak hydrogen peroxide solutions are known to be much more stable than more concentrated solutions. On the other hand it is also known, that it is much easier to stabilize dilute bleaches of this kind, even to the extent of complete protection.

When a bleach is thus most readily stabilized, its bleaching speed is not appreciably reduced. The contemplated ingredients will be discussed in further detail hereinafter.

Regeneration and reconditioning of the bleach is preferable effected in a return passage outside of the bleaching vessel. If the bleach is circularized by way of a pump, the replacement may be best effected in the vicinity of such a pump. The bleach should be introduced at one end and it should be withdrawn at the other end of the bleaching vessel.

The material to be bleached should now move counter to the flow of the bleach, but its movement should not be impeded in any other manner. However the soaking of the material to be bleached may be expedited and a complete change of the bleach contained in such material may be effected by the use of one or more wringers, e. g. a pair of pressure rollers. Such wringers find use at the end as well as at intermediate points of the bleaching vessel.

The material to be bleached may carry activators or catalizers; however the use of activators containing heavy metal should be avoided, since they have a detrimental effect upon the goods. As suitable alkaline substance soap may be given preference. Soap might for instance be left in the goods from a preceding washing operation.

The bleaching may be carried out in one or in a series of vessels or the material to be bleached may be recycled a number of times through the same vessel. In connection with a number of vessels a relative adjustment of the concentration of the bleaching agent, or of othe other ingredients may be in order; regardless of modifications and concentrations, a regulation of the procedure will also be obtained by a temperature differentiation between the bleach in the different vessels or by passing the material to be bleached at different speeds through the various vessels.

Alkaline stabilizer, as they have been frequently used in the past, cannot be recommended in connection with a continuous bleach of the instant invention, since an agitated bleach decomposes rapidly in spite of such protection. On the other hand ingredients which tend to reduce the pH value were found to be eminently useful; for instance, above all, acids. However there must be discrimination in the choice of the acid. The following stabilizers may be found useful, because they yield colloidal solution:

Albuminous products and decomposition products of albumen, like glue, gelatine, starch, sugar, mannite, cellulose derivatives, silica gel etc.

In addition anti-catalizers may be used to advantage, more particularly substances, which offset the action of traces of iron, since such traces are apt to cause a yellowing or other oxidation of the goods, particularly in connection with bleaches of low pH value: Aliphatic anions, like oxalate, tartrate, lactate, citrate etc. may be useful, or phosphate, pyro- or metaphosphate or borate. Protection by oxalic acid is therefore particularly advantageous.

Suitable other ingredients are wetting compounds which also exhibit a stabilizing effect, as there are, in particular, aliphatic sulphates or sulphonates of higher molecular weight. The following compounds may be suggested: The dodecanol-sulphate of sodium or triethanolamine, sodium- or triethanolamine-octadecenoyloxethaneaminosulphonate, sodium butylmethylcyclohexanol sulphate, sodium-dodecanolphosphate or pyrophosphate, etc.

The bleaching may be started in a bleaching vessel, and it is then completed by way of storage and of drying the goods. The bleaching vessels may be arranged in series or in stagger formation, the goods to be bleached moving always counter to the bleach. The goods may be wrung in and between the various bleaching vessels; after a short rinse, they may be carried away on rollers, which may be heated for drying purposes. If the goods are stored in a moist state, this may be helpful to remove obstinate stains, which are adapted for treatment by bleaches of very low concentration, but where the bleaching requires a longer duration of time.

The following examples are offered as illustrative rather than limitative of the instant invention;

Example 1

Woolen yarn, which has been washed and rinsed and in which substantially 1% (percent) of soap and 0.5% starch remain occluded, is passed—for instance continuously from the rinse—at a speed of 3.6 meters per minute in series through four vessels, or one vessel with four compartments, these containers being preferably made of rust proof material. In the compartments and therebetween may be arranged wringers, each compartment being substantially 80 centimeters long, with a capacity of 100 liters.

The bleach flows counter to the general direction of movement of the band of wool. It contains 0.5% hydrogen peroxide and .01% of oxalic acid. The bleach is circularized by a pump with a capacity of approximately 10 liters per minute. The material to be bleached was passed through each compartment in a zig-zag path, so that it traveled in each compartment for the distance of 2.5 to 3 meters. Near the pump the bleach is regenerated, i. e. replenished in respect to hydrogen peroxide and oxalic acid. The goods pass from the last of the compartments by way of a wringer, and the bleaching may continue during storage, being finally finished by drying.

Example 2

Bundles of rayon filament, or a mixture thereof with wool, pass as a sheet through five successive compartments at a speed of 3 meters per minute, the apparatus being otherwise arranged in the

manner of Example 1, glass being preferably used. The bleach should be used at substantially 30° Celsius containing approximately 0.8, but no more than 1.0% hydrogen peroxide, and 0.1% of sodium dodecanol sulphate. If the vessels are made of stainless steel preference is given to phosphate ion, e. g. meta-, pyro-, ortho-, or isopolyphosphates.

Generally speaking, preference is given to a bleach of a lower pH value in connection with the bleaching of animal or artificial fibre. In connection with the bleaching of vegetable fibre, the pH value should be higher.

Example 3

An unfinished yarn of wool, e. g. untwisted or only partly twisted, is passed ten times through a bleach containing 0.6% of hydrogen peroxide, 0.01% of oxalic acid, 0.06% of sodium octadecenoyloxethane sulphonate, and 0.02% of gelatine, at 40° Celsius. The damp goods are wound onto a reel and are allowed to dry thereon without rinsing, the temperature being about 30° Celsius.

EHRHART FRANZ.

Published June 15, 1943

Serial No. 203,242

ALIEN PROPERTY CUSTODIAN

ELECTROLYTIC PRODUCTION OF MANGANESE COMPOUNDS

Uscha Gottesmann and Hirsch Lowenstein, Paris, France; vested in the Alien Property Custodian

No Drawing. Application filed April 21, 1933

This invention relates to a process for the electrolytic production of manganese compounds.

It has frequently been proposed to produce potassium permanganate electrolytically by oxidation of manganese anodes. It has hitherto not been possible to utilise these processes industrially because passivation of the anodes could not be avoided and the efficiency was too small. It was, moreover, necessary to operate with cooling.

The disadvantages hitherto prevailing are overcome according to this invention by dividing the electrolytic production of the permanganate into two stages, manganate being prepared in the first stage and the permanganate only in the second stage. It is accordingly possible to obtain either pure manganate or pure permanganate at will.

The first stage of the process of this invention, the manganate stage, consists in electrolysing anodes of manganese alloys, for example ferromanganese or silico-manganese, in concentrated solutions of alkali hydroxides or alkaline earth hydroxides. The concentration of the alkali depends on the temperature and also on the current density employed, on the distance between the electrodes and the active surface of the electrodes. The criterion for the concentration is that the electrolyte solution must be green or must turn green. As soon as this is not the case the alkali concentration must be increased until the solution becomes completely green.

An essential advantage of the process of the present invention consists in that in this first stage the operation can be carried out at high current densities and without the use of a diaphragm, without chemical passivation of the anode taking place. Apparently permanganate is first formed, which in the presence of the strong alkali decomposes into manganate and oxygen with practically no formation of manganese dioxide.

If the electrolysis in the first stage is carried out for a sufficiently long time, the manganate is precipitated in solid form. Any tendency of the anode to become coated with crystals on prolonged working can be easily overcome by temporarily immersing the anode in water or in an aqueous solution. The liquor obtained by dissolving the crystals may be employed for dissolving the solid manganate precipitated in the electrolyte.

The electrolysis in this first stage may be carried out continuously with separation of the precipitated manganate, since the concentration of the electrolyte may be maintained at the desired value by the continuous or periodic addition of highly concentrated or even solid alkali.

The solid manganate or the manganate solution of the first stage may be employed as such.

In order to prepare permanganate either the solution of the first stage, if necessary after dilution and filtration, is oxidised in the second stage to permanganate, or the precipitated manganate is dissolved in water and very weak alkali or alkaline earth hydroxide, and this solution, after separating anode waste and ferric hydroxide, is subjected to oxidation in the second or permanganate stage. The latter method is attended with a considerable saving in heat, since less dilute liquor has to be evaporated.

Depending on the basic constituent employed in the first stage, the desired alkali or alkaline earth compound is obtained. The production of difficultly soluble manganates or permanganates may however, be facilitated by double decomposition. In this case sodium hydroxide is for example employed in the first stage and sodium manganate is produced. This sodium manganate may be converted into potassium manganate by interaction with potassium salts or it may be first converted in the second stage to sodium permanganate and only then be caused to interact with potassium salts to form potassium permanganate. The latter procedure is as a rule to be preferred, because the difference in the solubilities of the permanganates is greater than in the case of the manganates.

After separating the permanganate, the liquor poor in manganese, after simple evaporation with the addition of fresh alkali, may be re-employed in the first stage for the production of the manganate from ferro-manganese or the like.

When employing fresh or oxidised anodes it is advantageous at the beginning of the electrolysis to use a higher voltage than in the subsequent process thereof.

The following examples serve to illustrate how the process of this invention may be carried into effect:

1. A 35% potassium hydroxide solution is electrolysed at about 4 to 5 volts at room temperature with anodes of 80% ferromanganese and nickel cathodes without a diaphragm, the electrodes being spaced a few centimetres apart. The liquid is thereafter so adjusted that it contains about 85 gms. of potassium manganate and 50 gms. of potassium hydroxide, per litre. The liquid is then filtered and electrolysed in known manner to produce potassium permanganate. After thorough cooling the solid salts further pre-

cipitated are centrifuged off, the solution is evaporated down in vacuo and, if necessary, after adding potassium hydroxide, is returned to the first stage of the process.

2. 50% potassium hydroxide solution is electrolysed at room temperature with an anode of ferro-manganese (80% Mn) and a nickel cathode without a diaphragm. The voltage used is 2.6 to 4 and the distance between the electrodes a few centimetres. At the start of the electrolysis a higher voltage, for example 6 to 9 may be employed for a short time. After the electrolyte has become saturated with manganate, solid salt is formed, which together with ferric hydroxide and anode residues collects at the bottom of the vessel. The deposit is separated from the electrolyte liquor and centrifuged and is then washed with water, for example on a filter. The manganate goes into solution and is with advantage further electrolytically oxidised to permanganate. The liquor separated from the permanganate is with advantage evaporated down to 50% of KOH.

USCHA GOTTESMANN.
HIRSCH LOWENSTEIN.

Published June 15, 1943

Serial No. 224,636

ALIEN PROPERTY CUSTODIAN

COATING METHOD

Fritz Schmidt, Troisdorf, Germany; vested in the Alien Property Custodian

No Drawing. Application filed August 12, 1938

The present invention relates to a method of coating paper, textile fabrics and the like and is an improvement over the process described and claimed in my copending application Ser. No. 193,077 filed February 28, 1938 entitled "Coating Method and Product."

As described in said copending application, I have found that superior coated products can be formed in an easy and inexpensive manner by first applying to the base member to be coated, as by rolling or pressing, a soft, adhesive mass comprising artificial materials such as vinyl polymerizates or other polymerization products of unsaturated organic compounds or cellulose derivatives and the like and large quantities of non-volatile softeners, which mass is free from volatile solvents and which has the property of completely penetrating or intimately uniting with the base member. Thereupon a harder, less adhesive mass of similar materials but which contains considerably smaller amounts of non-volatile softeners is rolled or pressed onto the first coating. While the second or harder coating is incapable of firmly uniting directly to the base member, the interposition of the soft, adhesive coating layer not only impregnates the base member but also unites the hard, exterior coating to the base member. In this way it is possible to obtain products with hard, non-sticky coatings firmly attached to base materials. Since no volatlie solvents are necessary there is no need for drying of the coatings applied, no fire or health hazard and no need for elaborate solvent recovery equipment.

It is an object of this invention to provide a coating process which permits of the application of smooth, strongly adherent coatings of cellulose derivatives, hard polymerizates and other synthetic substances upon textile fabrics, paper and the like.

It is also an object of my invention to provide a process of applying flexible coatings of cellulose derivatives, hard polymerizates and other synthetic substances upon textile fabrics and paper which are stable to heat and cold, non-tacky and impermeable to water and gas which process completely avoids the use of volatile solvents.

I have now found that the process of my aforesaid application can be simplified and the foregoing objects realized in the following manner. The coating materials to be utilized in my process, i. e. the soft initial coating material containing large quantities of non-volatile softeners and the harder material used for forming the outer coating and which contains considerably less non-volatile softener are first formed into suitable foils. The said foils can be easily made as by casting or rolling the composition into a plate, film or band of the desired thickness. Then such foils as are desired are superposed upon the base member and then the several layers are simultaneously united as by continuous rolling or pressing, preferably with the application of heat. If so desired, the surface of the article may be given any desired ornamentation as for example graining by applying pressure to the surface of the article by means of a roller having suitable engraving on its surface.

The materials that may be formed into foils and used according to the present process are as follows. As the relatively soft material which may be directly applied to the base member but which is generally too soft to constitute the external coating of the product one can use the soft resinous mass such as is obtained by mixing vinyl polymerizates or cellulose derivatives with a relatively large proportion of a non-volatile softening agent. Alternatively such resinous materials as polymers or cellulose derivatives may be used as the initial coating material which are per se soft, such as moderately polymerized isobutylene or mixed polymerizates of vinyl chloride and considerable quantities of vinyl acetate or polymerizates of acrylic acid esters, polyacrylic acid esters or polyvinyl acetate alone in a soft polymerization stage or especially soft cellulose derivatives such as cellulose laurate. In all the latter instances it is not necessary to add any softening agents in order to maintain the softness of the mass. Because of their low viscosity, all these soft masses penetrate deeply into the interstices of the fabric or paper to such an extent that the fibers on the reverse side of the sheet are saturated upon calendering under the pressure of the rollers and at a moderate temperature, i. e. a temperature ranging from 70° to 110° C. A harder, thermoplastic mass which melts or softens only at a relatively high temperature, i. e. a temperature ranging from 120° to 170° C. is used as outer coating material and as such there can be used cellulose derivatives, polyvinyl compounds, polyacrylic acid esters, polymerized isobutylene and other polymerizates either alone or in combination with relatively small amounts of non-volatile plasticizers or softening agents. The following examples are given in order to show some specific applications of my process. It is to be understood that these examples are merely illustrative and that the present invention is not to be limited thereto:

Example 1.—In a vulcanization machine for rubber material, simultaneously a base material or fabric, a soft and viscous foil of approximately 0.3–0.5 mm. thickness which has previously been rolled or cast without a solvent, prepared from 40 parts of polyvinyl chloride and 60 parts of softener (for example, phthalic acid butyl ester), and a harder, non-viscous foil which has also been previously prepared by calendering or any suitable method from 75 parts of polyvinyl chloride and 25 parts of tricresyl phosphate are superposed one upon the other and run between the pressure band and the drum of the vulcanization machine which has been partly or entirely heated to 120–150°. The required pressing pressure is achieved by a hydraulic tension device. An intimate union of the 3 layers is thus obtained and there is produced in one operation a continuous, finished, laminated product which can be used for various purposes such as artificial leather, folding boat skin, etc.

The drum of the vulcanization machine can be supplied, as necessary, with a smooth, polished or dull surface or with any desired engraving for imparting the desired surface ornamentation to the final product. It is quite advantageous to arrange the pressing drum so that it may be heated in one sector and simultaneously cooled in an adjacent sector so that any surface ornamentation on the finished product can be set and thereby protected from damage.

By inserting several layers of material and a corresponding number of soft foils and also two harder exterior foils, a multi-layered homogeneously welded material of greater thickness can be produced, which can be used for example for belts and the like.

Example 2.—In place of the two polyvinyl chloride foils of Example 1, which differ in hardness through their softening agents, foils made from mixed polymerizates of vinyl chloride and acrylic acid methyl ester are used which distinguish substantially by the percentage content of both components so that the one intended for the inner layer is very soft and viscous, consisting for example, of 50% polyvinyl chloride and 50% polyacrylic acid ethyl ester while the other intended for the outer layer, though flexible is harder and non-viscous, consisting for instance of 70% polyvinyl chloride and 30% polyacrylic acid ethyl ester. The process is otherwise the same as in Example 1.

Example 3.—Two completely different polymerizates are used as upper and lower layer, for example an upper foil of non-viscous highly polymerized isobutylene and a lower foil of soft, viscous polyacrylic acid ethyl ester. The process is otherwise the same as in Example 1.

Example 4.—For the upper layer a foil of 80% ethyl cellulose and 20% benzyl naphthalene is used and for the lower layer a foil of 50% ethyl cellulose and 50% benzyl naphthalene.

Example 5.—For the upper layer a foil of 80 parts of benzyl cellulose and 20 parts tricresyl phosphate is used, and for the lower layer a foil of cellulose laurate, which is soft and viscous per se (without softener).

Example 6.—For the upper layer, a foil of 70 parts polyvinyl chloride and 30 parts tricresyl phosphate can be used, and for the lower layer a foil of 50 parts of after-chlorinated polyvinyl chloride and 50 parts of tricresyl phosphate.

While I have described my invention in some detail it is to be understood that numerous variations are possible without departing from the spirit of my invention.

FRITZ SCHMIDT.

Published June 15, 1943 Serial No. 230,120

ALIEN PROPERTY CUSTODIAN

AUTOMATIC CONTROL FOR AIRCRAFT AND THE LIKE

Eduard Fischel, Berlin - Charlottenburg, and Gerhard Rieper, Berlin-Lichterfelde, Germany; vested in the Alien Property Custodian

Application filed September 15, 1938

This invention relates to automatic control mechanisms for aircraft and the like, and more particularly to control mechanisms operating by means of a pressure medium such as air, water or oil, and is a substitute for our prior application Serial No. 728,644, filed June 2, 1934.

Mechanisms of the above-mentioned type generally work only periodically or at more or less long intervals; nevertheless, they must continuously be ready for operation. Consequently, it is desirable to generate only such a pressure of the operating fluid or amount of energy as is used actually for the controlling, and in this manner it is possible to attain a substantial reduction in the amount of energy used by the control mechanism.

It is known for the said purposes to make use of one or more air-vessels, in which the energy supplied by a pump or any source of power will be stored up during the interval between two control cycles. In connection with these vessels means are provided which will prevent the amount of stored energy from exceeding a predetermined amount.

It is also known for the above said purposes to furnish the control mechanism with two pumps for feeding the operating fluid, the one of which is feeding continuously while the other pump will begin to work and cooperate with the first mentioned pump on the arising of a great demand of pressure or energy.

In all these cases the control mechanism will become relatively complicated and voluminous, in consequence of which it would not be well adapted for automatic control of aircraft and similar purposes.

It is an object of the present invention to provide a comparatively inexpensive and simple device of small weight for effecting an increasing of pressure of the operating fluid on any increase of the demand of pressure or energy, thereby progressively increasing the speed of operation of the controlled member, such as the rudder or other control surface of an aircraft, as the device is moved further from its zero or neutral position.

The said device consists of a control valve arranged in such a manner in the output of the pump feeding the operating fluid of the control mechanism, as to secure automatically in response to needed energy an increase of the pressure, with which the valve disc is pressed on its seat, and consequently the pressure of the operating fluid.

Another object of the invention is to provide means connecting the member to be controlled, such as an aircraft control surface, with the said valve in such a manner that the position of the member or control surface to be controlled will determine the adjustment of the valve and therefore the pressure of the operating fluid, thereby progressively increasing the speed of operation of the controlled member, such as the rudder or other control surface of an aircraft, as the device is moved further from its zero or neutral position.

Still another object is to provide novel means whereby an automatic pilot will continuously apply corrections slowly by actuating the control surface of the aircraft slowly, to keep the craft on a predetermined course and/or on an even keel, and will apply corrections quickly by actuating the control surface at a faster rate when required, to counteract air disturbances such as bumps and gusts.

A further object of the invention is to provide, in combination with an aircraft having a control surface for controlling the aircraft about an axis, novel means for providing a variable speed of actuation of the control surface such that a minimum speed of actuation is obtained at and near the zero or neutral position of the servo mechanism and/or control surface and as the servo mechanism and/or control surface departs from the zero or neutral position in either direction, the speed of actuation of the surface is progressively increased as the departure of the control surface from neutral increases. Accordingly, large corrections for bringing the aircraft back to a desired attitude are produced more rapidly than heretofore, and small corrections are produced relatively more slowly.

In a fluid pressure operated servo motor of the piston and cylinder type, for example, the foregoing operation is obtained by increasing the fluid pressure to the servo-motor as the piston moves the control surface further from the zero or neutral position.

For a more complete understanding of the invention reference should be had to the accompanying drawing, in which as an illustrative example the invention is shown in its application to the controlling of a rudder of an aircraft although the invention can also be used for other purposes. It is to be expressly understood, however, that the drawing is merely for purposes of illustration and description only and is not to be construed as defining the limits of the invention, reference being primarily had for this purpose to the appended claims.

In the drawing, wherein like reference characters refer to like parts in the several views:

Fig. 1 is a plan view of one form of control mechanism embodying the invention as applied to the control of a rudder of an aircraft shown in dotted lines;

Fig. 1*a* is an enlarged sectional view of a servomotor and of a piston valve cooperating therewith;

Fig. 2 shows upon an enlarged scale the control valve of the embodiment according to Fig. 1; and

Fig. 3 is a diagram illustrating the relation between the moment required for the adjusting of the rudder or other control surface and the moment of the control mechanism in dependency on the angular adjustment of the rudder or control surface, or generally of the member to be adjusted by the control mechanism.

The invention consists substantially in the construction, combination, location and relative arrangement of parts for obtaining the results desired in accordance with the foregoing objects, as will be more fully hereinafter set forth in the specification, as shown in the drawing by way of example, and as finally pointed out in the claims.

Referring now to the drawing and more particularly to Fig. 1, the instrument **10** is shown as a directional device, for example, and serves to measure or to respond to the deviation of the aircraft from a predetermined direction and, as is shown in Fig. 1, it may be a liquid magnetic compass. The magnetic needle **11** of the compass carries an electrode **12**, movable between two electrodes **13** and **14** fixed to the compass casing **15**, which casing is filled with an electrolytic fluid and has a bearing for the pivoted needle **11**. The latter, as usual, points in the magnetic north-south direction and retains this direction substantially even when the aircraft swings about its upright axis. Such swing of the craft will bring either the electrode **13** or the electrode **14** closer to the electrode **12**, it being understood that all three electrodes (as well as the compass needle **11**) are within the casing **15** and in contact with the liquid therein. The compass casing **15** may be rotated about the axis of the needle **11** relatively to the aircraft for changing course, by means of the handle **16**, the shaft **17** and the worm gear **18**, the wheel of which is fixed to the compass casing **15** and the worm of which is mounted on the shaft **17**. The course for which the craft has been set can then be read off on the indicator scale **19** driven from said shaft **17** in any suitable manner as, for example, by worm gearing.

The above mentioned electrodes **12**, **13** and **14** of the compass **10** are arranged in an electrical circuit including the said electrodes and conductors leading therefrom, the electrodes **13**, **14** being connected with the terminals of the armature winding **21** of an electromagnet **20**, while the electrode **12** is connected with an alternating current source **22** through the regulating resistor **23**, the other terminal of said source being connected with an intermediate point of the winding **21**. As will be clear from the drawing, the armature winding **21** of the electromagnet **20** thus consists of two parts forming a differential system with the above said parts of the circuit. In consequence of this, the armature of the magnet will respond only to the difference in the currents flowing through the two parts of its winding and will, for that reason, take the zero position, if the needle **11** of the compass **10** is in the middle position between the two electrodes **13** and **14** fixed to the compass casing **15**.

At the beginning of the flight, the crank or handle **16** is operated to turn the compass casing **15** relatively to the aircraft to the position corresponding to the desired course as set with the aid of the indicator **19**. Assuming that the craft is following the intended course, the electrode **12** will be in exactly median position relatively to the electrodes **13** and **14**. This will cause exactly equal currents to flow through the two circuits supplied from the source **22**. One of these circuits includes the electrode **13**, the conductor leasing from said electrode to one terminal of the winding **21**, one-half of said winding, and the portion of the electrolyte between the electrodes **12** and **13**, together with a portion common to both circuits, viz. the electrode **12**, the needle **11**, the conductor leasing therefrom to the resistance **23**, said resistance, the current source **22**, and the conductor leading from said source to the intermediate point of the winding **21**. The other circuit includes, in addition to those common to both circuits, the following parts: the electrode **14**, the conductor leading therefrom to the other terminal of the winding **21**, the other half of said winding, and the portion of the electrolyte between the electrodes **12** and **14**. It will be seen that when, as assumed, the electrode **12** is in the median position, that is to say equidistant from the electrodes **13** and **14**, the resistance of the electrolytic liquid between **12** and **13** will be exactly the same as that of the liquid between **12** and **14**. Thus currents of equal strength will flow through the two halves of the winding **21**, and therefore the armature of the magnet **20** will remain in the median position illustrated by Fig. 1. Assuming now that the course of the aircraft is altered in such a direction as to bring the electrode **13** closer to the needle electrode **12** and consequently bring the electrode **14** farther away from said needle electrode (this relative position of the three electrodes is indicated in Fig. 1), the result will be that the resistance of the liquid between **12** and **13** is reduced, while at the same time the resistance of the liquid between **12** and **14** is increased. This will increase the current in the branch circuit containing the electrode **13**, and decrease the current in the branch circuit containing the electrode **14**. The armature carrying the coil or winding **21** will therefore be deflected in the corresponding direction (clockwise in Fig. 1). Should the course of the craft be altered in the opposite direction, so as to bring the electrode **14** closer to the electrode **12**, the armature of the electromagnet **20** will be deflected in the opposite direction (contra-clockwise in Fig. 1).

The armature of the electromagnet **20** is coupled by means of a lever **25** and a rod **26** to the one end of a differential lever **27**, the other end of which is pivotally connected by means of a rod **28** and a lever **29** to a so-called turn indicator **30**. The last mentioned instrument measures the angular velocity or rate of turn with which the aircraft deviates from the predetermined direction. It is well known to use such an instrument in connection with automatic steering devices for aircrafts for the purpose of preventing oscillations of the aircraft about the desired direction. The said differential lever **27** will accordingly move in response to the deviation of the aircraft from the desired direction and to the angular velocity with which the said deviation takes place.

Motion of the differential lever **27** is transmitted by means of a connecting rod **31** to a lever

32 linked at its one end to the said rod 31 and at its middle to a valve stem 33. At its other end the lever 32 is pivotally connected to a piston-rod 34, which carries two pistons 35 and 36 working in cylinder 37 and is coupled at its other end by means of a lever 38 to the member to be controlled, illustrated as the lateral rudder 39 of an aircraft. The said pistons 35 and 36 and the cylinder 37 constitute together the hydraulic servomotor for adjusting the member to be controlled.

By means of a conduit 40 the cylinder 37 of the hydraulic servomotor is connected to a source of operating fluid, illustrated as a pump 41 driven by a motor, for example an electromotor 42, and feeding out of a reservoir 43 into the said conduit 40. The fluid discharged by the hydraulic motor 35, 36, 37 passes through a conduit 44 to the said reservoir 43.

Transmission of operating fluid to the hydraulic motor is controlled by a three-part piston valve 45 fixed to the above said stem 33 and operating in a valve chamber 46 to which the conduits 40 and 44 are connected. The last mentioned conduit 44 is connected by a channel 44′ to the two outer ports 44″ of this chamber 46, while the first named conduit 40 enters the chamber 46 about its middle through a port 40′. The three parts of the piston-valve 45 are so arranged that in the position shown they will maintain the said three ports closed. On the right of the middle part of the chamber 46 are two ports 46′, 46″ which are connected by passages 47 and 48 respectively with the opposite ends of the cylinder 37. In the position illustrated, the piston valve 45 is clear of the ports 46′, 46″.

So far as the piston rod 34 is connected to the lever 32 it forms in the well kown manner the usual follow-up mechanism to restore the valve 45 to its original position. Thus, if for instance the armature carrying the coil 21 is deflected contra-clockwise, the linkage 25, 26, 27, 31, 32 is shifted to carry the valve stem 33 and the valve 45 downwardly, so that pressure fluid will pass from the conduit 40 through port 40′, the compartment of valve chamber 46 immediately above the middle member of valve 45, port 46′ and passage 47 to the lower compartment of cylinder 37. At the same time, the port 44″ will be uncovered so that as the pistons 35, 36 move upward, fluid may escape from the upper compartment of cylinder 37 through passage 48, port 46″, the compartment of valve chamber 46 immediately below the middle member of valve 45, port 44″ and channel 44′ to the conduit 44. The upward movement of the piston rod 34 will swing the lever 32 clockwise about its left hand end as a temporary fulcrum, and will thus lift the valve stem 33 and the piston-valve 45 back to their original position.

The novel means of the invention are now provided whereby a variable speed of actuation of the control surface or rudder 39 is obtained such that a minimum speed of actuation is obtained at and near the zero or neutral position of the pistons 35 and 36 and/or rudder 39, and as said pistons and/or rudder depart from the zero or neutral position, the speed of actuation of said rudder is progressively increased as the departure thereof from neutral increases. For this purpose and to this end there is provided, parallel to the above described feeding path for the operating fluid, a second feeding path including the valve 50, the conduit 49 and the reservoir 43. Referring to Fig. 2 showing the valve upon an enlarged scale the valve contains a valve disc 51 carried by stem 52 sliding in a cylindrical guide 53 forming part of a piston 54. This piston is guided at the one end of the valve chamber 55 which chamber is kept tight at the said end in any known manner. A spring 56 abuts at its one end on the said piston 54 and at its other end by means of a disc 57 on a shoulder on valve stem 52.

The piston 54 carries at its other end a bearing fork for a roll 58 engaged by a curved disc or cam 59 at its edge. The said curved disc or cam 59 is rotatably mounted at 60 and, as will be clear from Fig. 1, is connected rigidly with a toothed wheel 61 meshing by means of an intermediate wheel 62 with a toothed wheel 63, the shaft of which is coupled (for instance by a belt transmission 64) with the pivot of the control surface or rudder 39.

The above said curved disc or cam 59 is so shaped that upon rotation of the disc in the clockwise or counterclockwise sense it will move the piston forwards and increase the tension of spring 56. As the control surface or rudder 39 is coupled with the said curved disc 59, the deviation of said control surface or rudder from its middle or zero position will effect the said increase of the spring tension.

The operation of the mechanism is as follows: The parts are in Figs. 1 and 2 represented in the positions they occupy at the instant at which the aircraft or other body governing the control mechanism has the desired position. Upon deviation of aircraft from the predetermined direction, the piston valve 45 moves in response to the combined action of the compass 10 and the turn indicator 39. In consequence thereof the pistons 35, 36 of hydraulic motor will move in a well known manner and adjust the control surface or rudder 39 of the aircraft.

Upon rotation of the control surface or rudder 39 the curved disc or cam 59 also rotates in the manner described above thereby increasing the tension of spring 56. This has the effect that first the amount of operating fluid passing through the valve 50 and the conduit 49 decreases, and simultaneously the pressure and the amount of operating fluid fed into the conduit 40 will increase. As on the other hand the power or moment needed for adjusting the rudder 39 increases according to the amount of angular deviation of the control surface or rudder from its middle or zero position, the valve 50 will automatically adapt at each time the energy or pressure of operating fluid to the amount or value required momentarily, thereby providing a variable speed of actuation of the control surface or rudder 39, which varies with the amount of displacement of said rudder and/or pistons 35, 36 from the zero or neutral position thereof, and thus providing large corrections more rapidly and small corrections relatively more slowly for bringing the aircraft back to its desired course or attitude.

If the control or rudder 39 and, therefore, also the curved disc or cam 59 take the zero position, the tension of spring 56 and hence the load of pump 41 will have the smallest value. Inasmuch as at the said zero position the pressure of operating fluid must already have a certain value, it will be advantageous to form the curved disc or cam 59 in such a manner that the pressure will begin to increase only after a certain deviation of the said disc from zero position. This will also be advantageous in order to avoid disturbing pendulum effects. For a better understanding Fig. 3 shows approximately in line I the increase

of moment for adjusting the rudder and in line 2 the increase of pressure of the operating fluid both in dependency on the deviation of the rudder 39 from its zero position. That is to say, in Fig. 3 the abscissae indicate rudder deflections, while the ordinates indicate pressure (with reference to line 2) and moment (with reference to line 1). It has been found advantageous to choose the rate of the smallest pressure P_1 to the greatest pressure P_2 of operating fluid as 2:5 or greater.

It will be clear from the above description that the new control mechanism will adapt, in a very simple manner, the value of pressure or energy to the amount required at any time, and will progressively increase the speed of actuation of the pistons 35, 36 and/or the control surface or rudder 39 as the pistons and/or rudder depart further from their zero or neutral position. As described above the adjustment of the control surface or rudder 39 depends on the combined action of the two instruments 10 and 30. Therefore, the adjustment of the valve 50 coupled with control surface or rudder 39 will also depend on the combined action of the two instruments 10 and 30. Hence, it will be clear that besides the embodiment above described and shown in the drawing, in which embodiment the said instruments act upon the valve 50 by means of the hydraulic motor 35, 36, 37 and the rudder 39, other embodiments of the invention, in which the control instruments act upon the valve 50 in any other way, may be found by those skilled in the art.

By the term "free load" used in some of the appended claims in connection with the valve (51), is meant that the loading of the valve (exerted thereon by the spring 56) which tends to close said valve, or to hold it closed, is effected not by moving the valve itself but by simply adjusting (by means of the curved disc or cam 59) the pressure by which the valve is urged in the closing direction, independently of the position of the valve relatively to its seat.

EDUARD FISCHEL.
GERHARD RIEPER.

PUBLISHED

JUNE 15, 1943.

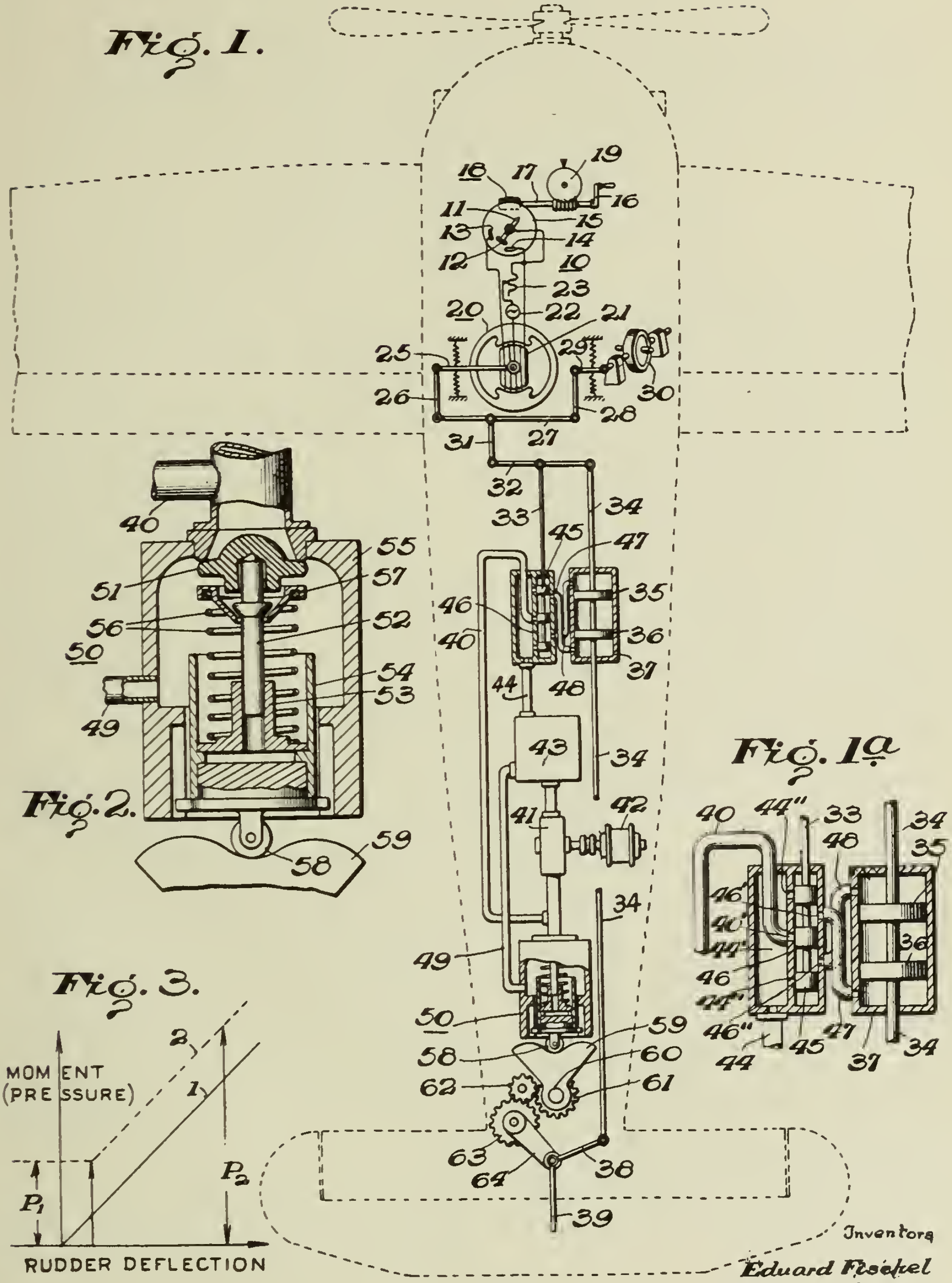
BY A. P. C.

E. FISCHEL ET AL

AUTOMATIC CONTROL FOR AIRCRAFT AND THE LIKE

Filed Sept. 15, 1938

Serial No. 230,120



Inventors

Eduard Fischel

Gerhard Rieper

By Stephen Cerstvik Attorney

Published June 15, 1943 Serial No. 233,783

ALIEN PROPERTY CUSTODIAN

LAMINATED PRODUCTS

Conrad Herrmann, Wuppertal-Elberfeld, Germany; vested in the Alien Property Custodian

No Drawing. Application filed October 7, 1938

My present invention has to do with the preparation of sheets composed of fibrous material and a condensation product.

More specifically my present invention concerns itself with the preparation of sheets or a series of sheets comprising separate laminated layers, each lamination consisting of artificially prepared staple fibres impregnated with a phenolic condensation product.

Although the present invention is described with especial reference to a phenolic formaldehyde or other phenolic condensation product it is to be understood that other condensation products which will give the same results are to be included in the term "phenolic condensation products" as used throughout this specification and the appended claims.

Hitherto it has been the practice to prepare a series of laminated plates which are superimposed to form blocks of materials for use in the manufacture of molded articles. These have been prepared through the use of cotton batting (see U. S. Patent #1,318,743) or of woven sheets comprised either of ordinary cloth or of artificial fibre. These sheets have hitherto been saturated with diluted solutions of Bakelite and subjected to a first drying without however completing the hardening thereof. The webs thus prepared were cut into blocks or plates of the desired size. In the prior art such plates were superimposed one above the other and subjected for some time to hot pressing in order that they may combine one with the other. For example, a pressure of from 500–1000 kg. per square cm. and a temperature of, for example, 150° C were employed. The resulting product is what might be termed a fused plate or block which may be further worked up by sawing, lathing, planing, milling, boring and polishing.

One objection to the process outlined above is that considerable quantities of the fabric are utilized in the preparation of such products. For example a composition of 40% fabric and 60% Bakelite is common. For this reason this procedure has been expensive because it was necessary first to spin the fibres into yarn and then prepare the fabric from this yarn.

Wishing to eliminate the costs enumerated above and still produce a satisfactory product I have conceived the following invention.

Essentially I utilize what I may term sheet-like distributed textile fibres. The loose fibre masses, according to my present invention, are worked up into a sheet-like card web on a carding machine and these card webs are directly impregnated with a sufficient quantity of a phenolic condensation product. I have found it preferable to free this card web from excessive solvents immediately by heating in a continuous operation. This product is then dried so that it may easily be handled, but it is not completely hardened.

These sheets thus preliminarily prepared are then placed one above the other in any desired shape, size or form, and pressed in order to complete the hardening.

The temperatures and pressures of the prior art may be employed in the final production of my laminated sheets.

It will thus be seen that by using staple fibres just as they are produced in the form of a thin matting I may secure results which have hitherto been possible only when the fibres were first spun and then woven into a fabric. Thus I have eliminated two expensive steps from this process, yet the end product is equal in strength and appearance to those produced in the prior art. The impregnation may be accomplished through the use of fine sprays arranged so as to contact the moving web either from above or from above and below. These sprays must be of such consistency that they do not seriously impair the continuity of the web thus being impregnated. For the support of the web during impregnation a porous or foraminous belt-like arrangement may be employed so that the Bakelite solution may drain off below and then be recovered and reused.

CONRAD HERRMANN.

Published June 15, 1943 Serial No. 235,108

ALIEN PROPERTY CUSTODIAN

MANUFACTURE OF SYNTHETIC MINERAL PRODUCTS

Wladimir Diterichs, Paris, France; vested in the Alien Property Custodian

No Drawing. Application filed October 14, 1938

The present invention relates to the manufacture of synthetic mineral matters and agglomerates, and in particular articles of this kind of monoblock form.

An object of the present invention is to provide articles of this kind which can be utilised as abrasive products, refractory products, insulating or conducting products for heat and/or electricity.

Another object of the present invention is to provide binders for the obtainment of the synthetic matters above mentioned from substances such as abrasive materials, refractory materials, insulating or conducting substances for heat and/or electricity, cementation and molding materials, and so on.

A further object of the present invention is to provide a method of manufacturing the products above referred to.

Still another object of the present invention is to permit of manufacturing in a synthetic manner crystallized materials and crystallized mineralogic species such as they exist in nature, and this with the following advantages: Due to the fact that the process involves the passage of the products through a fluid or pasty state, it is easy to give the final objects shapes that could at most be obtained at the cost of a slow and expensive work from the known natural species when the latter are bodies of considerable hardness; when these species are rare or difficult to obtain, the method according to the present invention reduces the cost and difficulty of obtaining them. Of course in the case of synthetic products identical to natural products, the invention involves these products only insofar as they are artificially obtained through my method. My invention also permits of creating crystallized mineralogic species which, as far as I am aware, were unknown up to the present time and constitute, on the other hand, valuable industrial products.

Still another object of the present invention is to provide products which, within their field of utilization, differ from the known products, comparable from the point of view of their utilization, by a higher percentage of truly active elements. For instance, in the case of refractory products, the infusibility of the whole product may be higher than that of the agglomerated material. Also, the cohesion of the finished product may be higher, and, if account is taken thereof, the hardness is greater.

The essential feature of the binder according to the present invention is the following: It includes, on the one hand, a mineral colloidal jel, on the other hand one or several mineral compounds kept in balanced solution through the network of the jel and capable of reacting both with this jel and with one another, with the production of defined crystals. Furthermore, the constituents of the jel (that is to say the mineral components of the jel and the mineral component or components of the mineral bodies in solution) are chosen in such manner as to produce crystalline systems which are identical, isomorphous, or compatible (for instance by twinning or by zoning) together and, eventually, with the crystals of the matter to be agglomerated if the latter is of crystalline structure.

A particularly advantageous kind of binders of this kind is that in which the chief elements have atomic numbers close to one another and to those of the chief elements or of the elements of the elements of the matter to be agglomerated.

According to still another feature, which has been found to be important from an industrial point of view, the binder for the agglomeration of a given raw material (that is to say a binder the components of which are chosen accordingly, as above explained) has characteristics corresponding not only with the nature of the raw material to be agglomerated but also with its granulometric composition and its density, and this, in particular, with a view to permitting an adjustment, as perfect as possible, of the adhesive and adsorption power, without involving, on the other hand, any change in the physico-chemical properties of the final crystals. It will be readily understood that it is possible, in this way, to obtain the highest possibility from the binder, and, in particular, to use a minimum amount of said binder for the preparation of the final product, and also to reduce to a minimum the duration of the treatments from the addition of the binder to the obtainment of the final product. The characteristics of the binder which are referred to are chiefly the volume of the mineral colloidal jel, the density of the solution retained by the jel and the final density of the binder. It is impossible to give, concerning these characteristics, a rigorous general law, but any person skilled in the art will be able, in every case, to determine the best possible characteristics, account being taken of the fact that the adhesive power varies in direct proportion to the density of the binder, which must also vary in direct proportion to the mean size of the grains of the matter to be agglomerated, whereas the adsorption power varies in inverse ratio to the density

of the binder and also to the mean size of the grains of matter to be agglomerated.

The preparation of the binders above defined from the constitutive elements, once the latter have been chosen with a view to the final product to be obtained, is effected as a rule through the known means and methods of the art. An example will illustrate the process to be employed in a particular case.

The method of manufacturing the final products from the binders and the matters to be agglomerated essentially comprises the intimate mixing of the binder and of the matter in question, the operation of giving the desired shape to the more or less fluid mass thus obtained, a drying at temperatures which, as a rule, average from 200 to 250° C., a baking at higher temperatures (above 1000° C.) with, possibly, periods for which the product that is being treated is maintained at the same temperature, for the obtainment of the phenomenons specific to each kind of matter that is treated, and finally a cooling.

In order to carry out the method according to the present invention, it is particularly advantageous to employ materials for agglomeration chosen from one or several of the following groups, given merely by way of example:

1. Abrasive products, both natural and artificial, such as emeris, corundum, silicium carbide, boron carbide, various carbides and nitrides, either alone or in the form of mixtures, flintstone, quartz, tripoli or rottenstone, and all abrasive compounds;

2. Natural or artificial alumina, simple or complex ores or oxides, such as bauxite, magnesite chromite, zircona, iron and chromium oxides; oxides of the elements of the rare group, glucinum, molybdenum, tungsten, titanium, vanadium, thorium.

3. Silica and natural or artificial silicates.

The invention has, among other advantages, that of permitting the utilization of such matters in proportions as high, for instance, as 85 to 98.8%.

For the constitution of the binders according to the present invention, I may make use, in particular, of bodies chosen, according to the nature, the granulometric composition, and, eventually the crystalline composition of the matter or matters to be agglomerated, in the following groups hereinafter cited merely by way of example:

1. Halogenous acids, such as hydrochloric and hydrofluoric acids;

2. Oxygenated acids, such as phosphoric, boric, silicic, carbonic, chromic, molybdic, tungstic, vanadic, titanic acids;

3. Salts of sodium, potassium, lithium, calcium, barium, glucinum, magnesium, aluminium, iron, chromium, zinc, tin, lead, and all metallic salts of the halogenous or oxygenated acids of the type of these mentioned under 1;

4. Natural or artificial oxides, either anhydrous or hydrated, of potassium, sodium, lithium, calcium, barium, glucinum, magnesium, aluminium, iron, chromium, zinc, zirconium; oxides of rare earths.

It is further possible to make use of matters capable of producing or maintaining, in the course of the thermal treatments, and more especially of the baking, a reducing, or on the contrary oxidizing atmosphere. As examples of matters of this kind, I will cite coke, graphite, coal in various states, mineral or vegetable oils, cellulose and its derivatives, oxides and salts of chromium and iron.

Finally, I may, if necessary, make use of secondary materials and fillers, for instance of dolomite, "chamotte," quartzite, apatite, infusorial earth, clays, kaolins, micas, feldspars, and so on, the additional bodies in question being, for instance, introduced at the rate of some percents.

In order better to explain the method according to the present invention for preparing the binders and the final products, I will hereinafter examine the various steps of the manufacture of a specific body, these indications having, of course, no limitative character.

I will consider the case in which it is desired to agglomerate a raw material consisting chiefly of rhombohedral alumina, and choice is made, for the constitution of the binder, of elements capable of supplying, after reaction and final crystallization, rhombohedral magnesian tourmaline having the following composition:

SiO_2	48.5
Al_2O_3	30.8
MgO	12.0
B_2O_3	6.9
Na_2O	1.8

These components are used in the form of the various products in commercial use. For instance, alumina is in the form of hydrate in an equimolecular phosphoric solution; magnesia is in the form of chloride of magnesium with 6 molecules of water; boron is in the form of boric acid; the latter, decomposed by the acidity of the medium, will add its free silica to the main silica introduced in the form of silica jel. In other words, for preparing 100 gr. of binder, I take the following elements:

	G.
A. Magnesium cholride of 30° Bé	26.2
B. Hydrate of alumina	13.3
Phosphoric acid of 60° Bé	28.1
C. Sodium silicate of 43° Bé	3.1
Water (for dilution of the silicate)	6.2
D. Silica jel with 40% water (D=1.60)	21.1
E. Boric anhydride	2.0
	100.0

I heat to 70° C., on the one hand, the magnesian solution to which there is added the boric anhydride, most of which will dissolve. During the cooling period, when the mass is at a temperature of about 50°, the silica jel is introduced. On the other hand, I dissolve, in a steam bath, until lactescent formation of metaphosphate occurs, the hydrate of alumina in phosphoric acid and I add the product thus obtained to the composition precedingly obtained. When the suspension is finished, I pour the small amount of silicate therein, while stirring moderately. The mixture is left alone for a period of at least seven days. The density of such a mixture is 1.51. It gives, after baking, a proportion of crystalline binder of 28.3% in weight. For one kilogramme of raw material to be agglomerated, I will therefore chose a weight of the mixture corresponding to the desired percentage of baked binder; for instance 70.6 gr., represent 20 gr. of crystals, that is to say an agglomeration at the rate of 2%.

When the mixture is made, it is important to take care that the value of the ratio of the molecular weights of the components which characterize the mineralogic species that are consid-

ered is correct. In the present instance, these molecular weights are those of SiO_2, Al_2O_3, MgO, B_2O_3 and Na_2O and they must correspond to the respective proportions in rhombohedral magnesian tourmaline.

In the mixture above defined, the volume of the colloidal jel, the density of the solutions retained by said jel and the density of this mixture have been chosen in such manner that the viscosity of said mixture, the power of adhesion to the grains of alumina to be agglomerated, and the power of adsorption of the reagents and of water are optima, account being taken of the granulometric composition of alumina (in the present case, corundum containing 99.5% of alumina of 80 Standard wires fineness, 85%; corundum containing 99.5% of alumina, of 100 Standard wires fineness, 15%) and of the physicochemical evolution of the medium.

The mixture is made homogenous, preferably in a colloidal mill, and it is malaxated with alumina and also with 1 or 2 per cent of coke powder in a mixer of suitable type. I add a small amount of water, i. e. from 0.5 to 1 per cent. I mold under a high pressure, the best results being obtained for values approximating 600 kgs per sq. cm (as a matter of fact, the shaping of the mass may include several known operations, such as pressing, wire drawing, pouring, etc.). The molded pieces are then carried to the dryer, where they are subjected to temperatures up to about 260° C. for periods of time ranging from 12 to 48 hours according to the size of the piece. The hardened pieces are taken from the dryer and baked for periods of time ranging from 2 to 7 days, according to the volume of the piece. They remain for a period of time from 6 to 18 hours at 1260°, are brought to a temperature of 1370° in 6 to 18 hours and kept at this temperature for 6 to 10 hours, after which they are allowed to cool and removed from the oven.

Although the process must not be considered as limited to details of operation resulting from the application of the complex phenomenons involved in the course of the treatment, it is advantageous to take into account the following remarks which will help in understanding the sequence of reactions taking place in the chosen example:

When incorporating the matter to be agglomerated to the binder and giving the shape to the mass, the crushing of the mass produces a reaction due to the breaking of the jel which releases the electrolytes which up to then were immobilized. When the drying operation takes place, the jel concentrates. As soon as the temperatures become lower than 100° C., a hydrolysis is started with the disengagement of acid gas and steam, which produces the phenomenon of solidification of the binder. This hydrolysis is exothermic, but it must be started by an external heat. From 100 to 260°, the water interposed between the cells is given off, which produces the final destruction of the jel. The double decomposition reactions begin to occur. From 260 to 600°, in the course of the baking, dehydration is completed and dry melting begins. The chlorides, borates, phosphates produce the formation of the first crystalline germs. Free silica passes at 570° into the state of trydimite. From 600 to 1000°, the double decomposition reactions take place, the chlorides are decomposed, the mineralizing reactions being to take place. At the same time, as a consequence of the disengagement of volatile elements, which disengagement takes place until the end of the heating, the melted bath is supersaturated. From 1000 to 1400°, phenomenons of dissolution, of molecular transformations of deposits by igneous supersaturation develop, with the production of the crystalline mineral species intended to be obtained when the composition of the binder was chosen. The reducing bodies begin to act.

In a general manner, the form of the baking curve, the height of the temperature, the time for which the products remain heated at various temperatures depend upon the minerals to be obtained, the melting temperature of the eutectics and the viscosity of the vitreous and dissolving bath.

The last step of the transformations precedingly described is that of the cooling, that is to say of the petrifaction, of the mass. The equilibrium of the melted bath containing the crystals which have been produced under the effect of double decompositions or respective supersaturations is unstable. The bath remains in the liquid or vitreous state only owing to an excess of silica resulting from he primitive jel. During the cooling, the mass contracts, same as, during the dehydration at the beginning, the jel had contracted. The excess of silica, alumina, etc. is driven out. This is the reason why the cooled binder often shows, in thin lamellas, a porphyritic or trachytic structure.

WLADIMIR DITERICHS.

Published June 15, 1943

Serial No. 237,278

ALIEN PROPERTY CUSTODIAN

CONDENSATION PRODUCTS

Robert Behnisch and Paul Pöhls, Wuppertal-Elberfeld, Germany; vested in the Alien Property Custodian

No Drawing. Application filed October 27, 1938

This invention relates to condensation products of 4.4′-diaminodiphenylsulphone and to a process of preparing the same.

4.4′-diaminodiphenylsulphone and 4.4′-diacetyldiamino-diphenylsulphone have a good activity against streptococci and pneumococci infections of the mouse, the utility of the 4.4′-diaminodiphenylsulphone for this purpose is however decreased by the fact that the said product gives rise to the formation of methemoglobin.

In accordance with the present invention new products are obtained which show a considerably increased activity when compared with the afore-mentioned products and which do not further give rise to the formation of methemoglobin. Applicants have found that the condensation products of 4.4′-diaminodiphenylsulphone with aldehydes are free from the disadvantages of the afore-mentioned compounds. The new condensation-products may contain 1 or 2 molecules of the aldehyde which are combined with one or both amino-groups of the 4.4′-diaminodiphenylsulphone. The condensation takes place while splitting off one molecule of water upon each molecule of aldehyde. In general applicants' new condensation products probably have the structure of the so called Schiff's bases, that is, in the condensation product the carbon atom of the aldehyde-group is combined with the amino-group(s) of the diaminodiphenylsulphone by means of a double bond.

In accordance with the present invention the new condensation products are obtainable by heating 4.4′-diaminodiphenylsulphone with an aldehyde. The most various aldehydes have proved useful for this process, for instance, aliphatic aldehydes, aromatic aldehydes, such as aldehydes of the benzene and naphthalene series, furthermore mixed aliphatic aromatic aldehydes and heterocyclic aldehydes. Depending on the activity of the aldehyde-group the condensation products contain one or two aldehyde radicals. Applicants have found that the condensation often may be facilitated by the presence of catalysts; 4.4′-diaminodiphenylsulphone-hydrohalides which sometimes are contained to a slight extent in the 4.4′-diaminodiphenylsulphone of technical manufacture, for instance, have proved operable as such catalysts, furthermore ammonium halides, hydrohalides of tertiary amine, such as triethylamine, pyridine. When using such catalysts often condensation takes place with 2 molecules of the aldehyde; 2 molecules of aldehyde are also condensed in general when the reaction mixture is heated to melting, for instance, to a temperature of about 150 to about 180° C. In other cases it is advisable to heat the reaction mixture in the presence of a solvent, particularly in the presence of an alcohol, such as methyl, ethyl, isoamyl alcohols and the like. The condensation can also be effected in stages, for instance, by first using for the condensation a slightly active aldehyde, so that a mono-condensation product is formed which subsequently is subjected to further condensation with a more active aldehyde or under the more effective reaction conditions referred to above. In this manner also condensation products are obtainable containing two different aldehyde radicals.

The invention is further illustrated by the following examples without being restricted thereto:

Example 1.—24,8 grs of 4.4′-diaminodiphenylsulphone are heated to boiling with 30 grs of cinnamaldehyde in 300 ccms of alcohol during 15 minutes. The condensation product begins to separate already in the boiling heat. After cooling it is filtered with suction and washed with alcohol and ether. In this way the 4.4′-bis-(cinnamylidenamino)-diphenylsulphone is obtained. It forms light yellow leaflets melting at 236° C. In a corresponding manner there are obtained when using:

Propionaldehyde the 4.4′-bis-propylidenamino-diphenylsulphone melting at 246° C.

Benzaldehyde the 4-benzylidenamino-4′-amino–diphenylsulphone melting at 214° C.,

4-tolylaldehyde the 4,4′-bis-(4′′-methylbenzylidenamino)-diphenylsulphone melting at 250° C.,

2-hydroxybenzaldehyde the 4.4′-bis-(2′′-hydroxy-benzylidenamino)-diphenylsulphone melting at 259° C.,

4-methoxybenzaldehyde the 4-(4′′-methoxybenzylidenamino) - 4′ - amino - diphenylsulphone melting at 226° C.,

4-chlorobenzaldehyde the 4.4′-bis-(4′′-chlorobenzylidenamino)-diphenylsulphone melting at 233° C.,

3,4-methylendioxybenzaldehyde the 4-(3′′,4′′-methylendioxy-benzylidenamino)-4′-amino - diphenylsulphone metling at 227° C.

The melting points of the afore-mentioned condensation-products may be different corresponding to the state of purity of the starting material; a further purification of the products often is not possible because of their insolubility in organic solvents.

The condensation often is favourably influenced by using technical diaminodiphenylsulphone which still contains some small quantities

of its dihydrochloride. In this case, for instance, with 3,4-methylendioxy-benzaldehyde directly the 4.4'-bis-(3'',4''-methylendioxybenzylidenamino)-diphenylsulphone is obtained, melting at 231° C.

In the same manner also other aldehydes, for instance, β-hydroxypropionaldehyde, glycerolaldehyde, valerianaldehyde, butyraldehyde, chaulmoogrylaldehyde, nitrobenzaldehydes, vanillin, acetylaminobenzaldehyde, phenylacetaldehyde, resorcinolaldehyde, phloroglucinaldehyde, terephathalic aldehyde-acid, 1-hydroxynaphthalene-4-aldehyde, 2-hydroxynaphthalene-1-aldehyde, glucose, galactose, maltose, furfurol, α-furyl-acrolein, pyridine-3-aldehyde, 2-methylindol-3-aldehyde, quinoline-2-aldehyde may be reacted.

Example 2.—10 grs of 4,4'-diaminodiphenylsulphone and 25 grs of 4-chlorobenzaldehyde are heated to 170–180° C. while slowly passing through a current of nitrogen until the water split off during the condensation is distilled off which takes about 10 minutes. The cold melt is triturated and boiled with ether whereby the 4.4'-bis-(4'' - chlorobenzylidenamino) - diphenylsulphone remains undissolved. It is sucked off; it melts at 233° C. The yield amounts to 90% of the theory.

In the same way when using benzaldehyde there is obtained the 4.4'-bis-benzylidenamino-diphenylsulphone melting at 236° C., when using 4-methoxybenzaldehyde the 4.4'-bis-(4''-methoxybenzylidenamino)-diphenylsulphone melting at 241° C.

Example 3.—10 grs of the 4-(4''-methoxybenzylidenamino)-4' - amino - diphenylsulphone melting at 226° C. obtained as per Example 1) are heated to 170–180° C. with 20 grs of 4-methoxybenzaldehyde while slowly passing through a current of nitrogen until the reaction-water is distilled off. The melt is poured into hot alcohol while stirring the precipitate filtered with suction and washed with alcohol and ether. The 4.4'-bis-(4''-methoxybenzylidenamino)-diphenylsulphone obtained forms colorless crystals melting at 240° C.

ROBERT BEHNISCH.
PAUL PÖHLS.

Published June 15, 1943 Serial No. 245,916

ALIEN PROPERTY CUSTODIAN

SULPHONATION PRODUCTS AND A PROCESS FOR THE MANUFACTURE OF THE SAME

Richard Michel, Krefeld-Uerdingen, and Hans Buschmann, Schkopau-B. Merseburg, Germany; vested in the Alien Property Custodian

No Drawing. Application filed December 15, 1938

This invention relates to sulphonation products of allyl substituted aromatic oxy compounds and a process for the manufacture of the same.

According to the invention aromatic oxy compounds comprising at least one allyl radicle or at least one substituted allyl radicle linked to the aromatic nucleus and/or to a hydroxyl oxygen and which are advantageously substituted in addition on the aromatic nucleus by at least one other hydrocarbon radicle, by treatment with with agents of sulphonating action are converted into valuable capillary active substances.

By the addition of sulphonating agents, such as sulphuric acid or chloro sulphonic acid and advantageously sulphuric acid in admixture with acetic anhydride or acetyl sulphuric acid, the sulphonic acid group apparently becomes attached to the allyl radicle. In general it is to be recommended to cool the reaction mixture during the action of the sulphonating agent with ice.

Among the said aromatic oxy compounds may be mentioned phenols, such as phenol, cresol, xylenol, oxydiphenyl, pyrocatechine, resorcinol, halogenated phenols, such as chloro phenol or bromo cresol, nitro phenols, furthermore naphthol, chloro naphthol, methyl or ethyl naphthol, finally functional derivatives of a phenol, such as anisol, phenetol, phenyl acetate, phenyl propionate, naphthyl methyl ether, naphthyl ethyl ether and so on. To the aromatic nucleus and/or to a hydroxyl oxygen of these aromatic oxy compounds are linked one or more allyl radicles or one or more substituted allyl radicles, that is to say, unsaturated hydrocarbon radicles in which the position of attachment to the aromatic nucleus or to the hydroxyl oxygen is separated from a double bond by a singly linked carbon atom, for example a crotyl radicle, a pentenyl radicle, a hexenyl radicle, a heptenyl radicle and so on. Furthermore the aromatic oxy compounds are advantageously substituted in addition on the aromatic nucleus by at least one other hydrocarbon radicle, for example a propyl, butyl, hexyl, octyl, dodecyl, octadecyl or benzyl radicle.

Thus the following aromatic compounds can be sulphonated with advantage according to the process of this invention: o- and p-allyl phenol, crotyl phenol, o-hydroxy phenyl-1-hexene-2, di- and triallyl phenol, phenyl allyl ether, phenyl crotyl ether, allyl phenyl allyl ether, chloro allyl phenol, bromo allyl phenol, nitro allyl phenol, allyl cresol, eugenol, allyl eugenol, eugenol allyl ether, acetyl allyl phenol, allyl anisol, isododecyl allyl phenol, isododecyl allyl phenyl ether, n-octadecyl allyl phenol, allyl-α-naphthol, allyl-β-naphthol, naphthyl allyl ether.

Likewise there are suitable as starting materials allylated phenol carboxylic acids, for example allyl salicylic acid and their derivatives alkylated in the nucleus.

Among the sulphonic acids thus obtainable those exhibit particularly good properties which altogether include at least 3 side chain carbon atoms.

The sulphonic acids of this invention may be employed as such or especially in the form of the alkali salts as capillary active compounds, for example as wetting or dispersing agents in the manner known in the art.

The invention is illustrated but not restricted by the following examples; the parts are by weight:

Example 1

Into 500 parts of acetic anhydride with ice cooling 200 parts of concentrated sulphuric acid are stirred within 60 minutes. Then, likewise with ice cooling, 435 parts of isododecyl allyl phenol (boiling point 160–180° C. under 1 mm) are added during 60 minutes. After 1 hour the reaction product is soluble in water to a clear solution. After dilution with water the whole is neutralised with caustic soda lye and thereby at the same time the sulphonic acid salt produced salted out. After drying in vacuum it constitutes a light yellow powder which is distinguished by good wetting and foaming effect.

The isododecyl allyl phenol is obtained in such a manner that from an isododecylene, produced by polymerisation of propylene, and phenol, in the known manner isododecyl phenol is produced, this is converted with allyl chloride and alkali into its allyl ether and the latter rearranged by heating into the o-allyl-p-isododecyl phenol.

Example 2

Into 500 parts of acetic anhydride with ice cooling 200 parts of concentrated sulphuric acid are stirred within 60 minutes. Thereupon 435 parts of isododecyl allyl phenyl ether are added within 60 minutes. After 5 hours complete water solubility results. The working up is carried out in the manner described in example 1. The product likewise possesses good wetting and foaming effect.

Example 3

Into 125 parts of acetic anhydride are stirred with ice cooling within 30 minutes 34 parts of concentrated sulphuric acid. Thereupon 110 parts of allyl n-octadecyl phenol (boiling point 220–240° C. under 1 mm) are dropped in. After 5 hours reaction complete water solubility is achieved. The working up takes place in the manner set out in the preceding examples. The sulphonic acid salt obtained is distinguished in this case by particularly good washing properties.

RICHARD MICHEL.
HANS BUSCHMANN.

Published June 15, 1943

Serial No. 246,211

ALIEN PROPERTY CUSTODIAN

LUBRICATION OF AERO AND OTHER ENGINES

Emile Piquerez, Saint-Cloud, France; vested in the Alien Property Custodian

Application filed December 16, 1938

This invention relates to the lubrication of aero and other engines and has for its chief object the provision of improvements in the lubrication of such engines when starting, particularly under conditions of low temperatures.

In a general way the lubrication of aero engines is effected by means of a pump which is fed from a reservoir and forces the oil into the crankshaft of the engine, the said reservoir being itself fed by a so-called exhaust pump, which, drawing the oil from the crankcase of the engine, forces it through a radiator, the object of which is to ensure the cooling of the oil, to the reservoir. The first said pump, properly called the lubricating pump, is provided with a by-pass which opens at a predetermined pressure and, when the resistance to the lubricant flow and consequently the pressure in the crankshaft, rises above the aforesaid pressure limit, discharges directly into the engine crank case or returns the lubricant to the inlet side of the pump.

When starting in cold weather the oil may be congealed in the crank case. The resistance which it then offers to the delivery of the pump causes the operation of the said by-pass, so that, in the absence of any other arrangement, the lubrication of the engine is inadequate or uncertain.

The only way of overcoming this drawback in practice has been to heat the oil in the feed reservoir of the lubricating pump either in situ, which is often inconvenient and is always a lengthy procedure, or in a separate vessel, which necessitates the provision of heating devices, some forms of which have no connection with the said reservoir, the contents of which are completely transferred, while others of which are included in a closed circuit starting from and returning to this reservoir.

In all these cases the apparatus is expensive, generally bulky, and in any case only permits of starting being effected after a lapse of sufficient time for the heating of the oil. It is an object of this invention to provide a method for ensuring the lubrication of engines of all types, but more particularly of aero engines, when starting in cold weather, whereby these drawbacks are avoided.

This method consists essentially in delivering into the crankshaft, an auxiliary flow of hot oil additional to the main flow of oil from the lubricating pump, the said hot oil being under a pressure greater than the delivery pressure of the pump so that this hot oil passes into the crankshaft forming eventually an annular stream around a core of cold oil; and then passes directly to the discharge ports of the crankshaft, ensuring on the way the liquefying of the cold oil. This injection of hot oil can take place either before the starting of the engine or during the starting thereof. In this last case the injection can be effected concurrently with the flow of oil coming from the lubricating pump; but the quantity of the supply should be less than that of the latter.

The lubrication of the engine is thus assured from the start by means of at least the hot oil so that the engine can begin to operate immediately. The engine then itself constributes to the heating of the lubricating oil; it being understood that the auxiliary injection of hot oil can be very limited in duration and in quantity.

The preliminary heating of the oil of the auxiliary flow injected according to the present method can be effected by any suitable means, but an important improvement can be applied to the method already set forth by providing a reserve of hot oil for the injection by withdrawing a proportion of oil from the engine lubricating circuit itself during the running of the engine when the oil is consequently at a relatively high temperature. It will in this way be sufficient to insulate this reserve thermally and to supply it with only enough heat to make up for the losses of the insulated system, and in this way ensure, during the stopping of the engine, that this reserve is in a condition to be used for the next starting. Further, the compressed air ordinarily provided and stored on the aeroplane itself is advantageously used to provide the pressure for the injection of the auxiliary flow of hot oil.

It is also an object of the invention to provide apparatus for carrying out the present method, comprising essentially a storage container for hot oil provided with a piston dividing it into two compartments of variable size, one of which is connected to a source of fluid under pressure, while the other, containing the hot oil, is connected to the inlet of the crankshaft of the engine, jointly with the discharge of the lubricating pump, a non-return valve being provided in this discharge below the by-pass to prevent any possibility of the hot oil flowing back towards the pump and towards the feed reservoir.

In an advantageous construction for carrying out the improved process as set forth above, the pressure chamber of the said container is provided with means for connecting it with the atmosphere, the operation of which means, after the emptying of the container when the engine

is running normally and after the lapse of a certain time, permits of this tank being re-filled with the oil of the normal lubricating system which under these conditions is at a relatively high temperature, the operation being effected preferably just before the stopping of the engine. The piston in the container can be omitted, in which case the container is provided with means for, on the one hand, closing the oil outlet once the emptying has been completed, and, on the other hand, shutting off the communication of the container with the atmosphere at the end of the filling operation.

The container having been filled in the manner set forth above, can be enclosed in a thermally insulated casing which is provided with a permanent source of heat, which can be sufficient merely to compensate for the slow heat losses of the insulated system and the losses by conduction along the pipes.

This heat source can consist, for example, of an electric resistance fed from the current supply of the aircraft, or it can consist of a catalytic petrol heater.

This system can be further improved by the adoption of means avoiding losses by conduction along the pipes. To this end the container is movably connected between two quickly detachable couplings, and an insulating and heating casing capable of receiving the detached container is provided.

The heating means can in this last case have a lower heating power than in the aforesaid case. This last system can be arranged separate from the aircraft and this avoids the necessity of using means on the craft, in particular the current from the batteries.

Finally it is obvious that the power of the heating means can then be very much reduced, it being understood that the thermally insulating means can be arranged to ensure the maintaining of the temperature for a relatively long time. It would be of advantage to arrange that this heating means should be able, when necessary, to furnish a greater supply of heat which would only be required when it is desired to effect the complete initial heating of the contents of the container before putting it into use.

Finally it follows that, in place of the aforesaid arrangements, a permanent supply of oil containers can be provided on the aerodrome arranged in a heating and insulating casing. These would be used in accordance with requirements, the container which has just been removed being replaced each time by a full container, such as that which would have been removed from the engine.

The accompanying drawings show by way of example a schematic arrangement of apparatus for carrying out the method according to the invention, and the adaptation of this apparatus to a particular engine. In the drawings:—

Figure 1 shows the assembly diagrammatically in elevation and partly in section;

Figure 2 shows in vertical section an arrangement for heating the container when removed from the apparatus;

Figure 3 is a partial longitudinal section of a particular engine to which the apparatus is applied;

Figure 4 is a section along the line 4—4—4—4— of Figure 3, and

Figure 5 is a vertical diagrammatic section of another form of container.

As can be seen from the drawing (Figure 1) the apparatus for carrying out the method according to the invention comprises essentially a container 10, preferably constructed of metal, which is provided with an internal sliding piston 11 which defines two compartments 12 and 13 one of which, 12, is connected to a source of air under pressure, such as a reservoir, while the other 13 containing the hot oil is connected to the inlet of the internal passage 14 of the crankshaft 15 of the engine, for example by means of the box 16 normally provided for the admission of the oil delivered by the lubricating pump 17.

In Figure 1, 18 indicates the feed reservoir of the said pump 17, which reservoir is itself fed by the pump 19, drawing from the crank case 20 through the radiator 21.

The container 10 is connected to the source of pressure air and to the crankshaft, for example by pipes 22 and 23 respectively. A valve 24 in the pipe 22 enables the admission of air under pressure to be permitted or prevented at will.

The container 10 can be permanently connected between the pipes 22 and 23. In this case it would be surrounded in place by some suitable source of heat, itself preferably contained in an insulated casing.

In the particular preferred embodiment of Figure 1 the container is removably connected between the two pipes, for example by means of quick action couplings 25 and 26 having a valve opening automatically under the action of the coupling. In this case a valve 27 included in the pipe 23 enables the latter to be closed when the container is not in place. In the drawing (Figure 1) the container is shown as being detached from the pipe 23 solely for the purpose of showing the coupling 26 more clearly. To avoid all error in connecting up it is advantageous to provide two types of coupling, the one 25 having three coupling dogs and the other 26 having two dogs.

In the above case where a removable container is used it is obvious that it could be refilled outside the apparatus by suitable means, but as has been said this operation is advantageously performed by refilling the container in place, when it has fulfilled its purpose, by means of the lubricating pump itself. For this it will suffice to provide means for connecting the compartment 12 to the atmosphere for example by means of a valve 28.

When this is possible the installation can be completed by providing a check valve such as 29 below the passage of the by-pass 30 of the pump 17, the valve of which is indicated at 31. This is to avoid any flow of the hot oil in the direction of the pump, and beyond it. By reason of the small flow of the hot oil and its direct passage leading to the crankshaft and thanks to its high pressure the possibility of a back flow towards the pump is very unlikely.

In these conditions, assuming the container to be full of hot oil and in place in the apparatus, the operation is as follows:

The valves 27 and 24 are opened, the valve 28 being closed. The compressed air entering the container forces back the piston 11 which by its movement gradually forces the hot oil from the compartment 13 into the pipe 23 and thence to the box 16 and the crankshaft 14—15.

While allowing that this last may be full of cold congealed oil, it will be clearly understood that the injected oil will find a passage around the core of cold oil and will advance in the form of an annular stream around this core. Thus while

liquifying the cold oil it will pass directly to the delivery ports of the crankshaft so that lubrication of the engine will begin, it being ensured that the latter can, under these conditions, be started at the same time as the injection of hot oil or some moments after the beginning of this injection.

Hence the fluidity, and consequently the rate of flow, of the main oil, which is initially negligible, will increase rapidly owing to the additional heating provided by the operation of the engine, and at the end of a short time the main flow by itself will be sufficient to ensure lubrication. The capacity of the container and the rate of flow of hot oil will naturally be adjusted so that this flow stops at this moment.

When the aeroplane is nearly ready to land, at any rate a little before the stopping of the engine, it is enough merely to open the valve **28** communicating with the atmosphere, after having closed the valve **24** to avoid any loss of compressed air, to ensure the automatic filling of the container with oil from the main lubricating system itself, which oil is consequently already at a relatively high temperature.

In order to have this reserve when a fresh start is made it will, in practice, suffice to maintain the temperature of the oil or to increase it slightly. To do this, in the embodiment according to Figure 1 where the container is removable, the valve **27** is closed and the container lifted up and transferred to an insulating and heating apparatus such as that shown in Figure 2, arranged either on the craft, or on land.

This apparatus comprises, for example, a casing **32** provided with a quick acting cover **33** and having an internal heat insulating lining **34** and heating means such as an asbestos-covered or otherwise insulated electrical resistance **35**. An air space is left between this resistance **35** and the lining **34** while a connector **36** permits the supply of current to the resistance. The free internal space of the apparatus is adapted to receive the container **10** to which are attached only the two coupling elements.

The heating capacity of the resistance **35**, or of any other heating means which may be employed can be a minimum, less than in the case where the heating is effected on board the aeroplane, owing to the fact that the losses by conduction along the pipes are avoided. It would be desirable, nevertheless, to make it sufficient for it to be able to effect in time the entire heating of the contents of the container, which would only be necessary when the container is first put in service. In the case of an electrical resistance it is sufficient for this purpose to provide a rheostat or the equivalent.

It will be understood also that, in place of an arrangement of a single container such as that of Figure 2, a number of such arrangements could be provided, with a casing having a number of compartments, so as to provide a reserve of containers which are used as required, each container removed being replaced by a full container such as that just being replaced on the aeroplane.

Figures 3 and 4 show a modified adaptation of the apparatus to a particular engine, which is only distinguished from the preceding arrangement by the fact that in this case there is no check valve **29**.

In Figure 3, **15^1** indicates the crankshaft and **14^1** its internal passage. The latter is in this case supplied through a passage **37** within the pump operating shaft **38**, which passage opens at its after extremity into a chamber **39** communicating by means of ports **40** with a casing **41** enclosing the operating gears of the various pumps.

In Figure 4 the chamber **39** is shown as a pipe in order to make this figure more understandable. In Figure 4, **42** indicates one of the gears of the lubricating pump which discharges into the axial passage **43** opening into the chamber **41**; **44** indicates the by-pass valve of this pump.

The injection of the auxiliary stream of hot oil takes place through the conduit **23^1** which is identical to the conduit **23** of Figure 1. This conduit ends in a pipe **45** which connects it with a passage **46** opening into the chamber **41**.

The apparatus supplying hot oil is not reproduced in Figure 3 being similar to that of Figure 1.

The apparatus described above can naturally operate in any position.

In the embodiment of Figure 5 the container, which is arranged to operate only in a vertical position, does not comprise a piston, but is provided with means, on the one hand, for closing its discharge opening at the end of the emptying operation to avoid the admission of compressed air into the lubricating system and, on the other hand, for cutting automatically the communication with the atmosphere at the end of the filling of the container with oil drawn from the lubricating system.

As can be seen from Figure 5, in this embodiment the hot oil container **50** comprises, on the side where the compressed air is admitted a float **51** guided in any suitable manner and attached to a valve **52**. This latter is adapted to close the port **53** at the completion of the filling of the container with hot oil from the main lubricating circuit of the engine, the valve **28** communicating with the atmosphere then being open and the compressed air valve **24** closed, as has been explained above.

As soon as filling is complete the valve **28** is closed.

The container being full can be left in place in the case where thermally insulating means has been provided to maintain the temperature of the hot oil.

When the time for the oil to be used arrives it is sufficient to open the compressed air valve **24** and the contents of the container will be delivered to the crankshaft of the engine through the pipe **23**.

To prevent the admission, at the end of the emptying of the container, of compressed air into the lubricating system, there is provided at the bottom of the container another valve arrangement **54** having a float **55** adapted to close the outlet port **56** at that moment. It is obvious that the functions of closing these ports **53** and **56**, opened in good time, could be fulfilled by two valves attached to a single instead of to two floats.

EMILE PIQUEREZ.

PUBLISHED | E. PIQUEREZ | Serial No.
JUNE 15, 1943. | LUBRICATION OF AERO AND OTHER ENGINES | 246,211
BY A. P. C. | Filed Dec. 16, 1938 | 3 Sheets-Sheet 1

Fig. 1

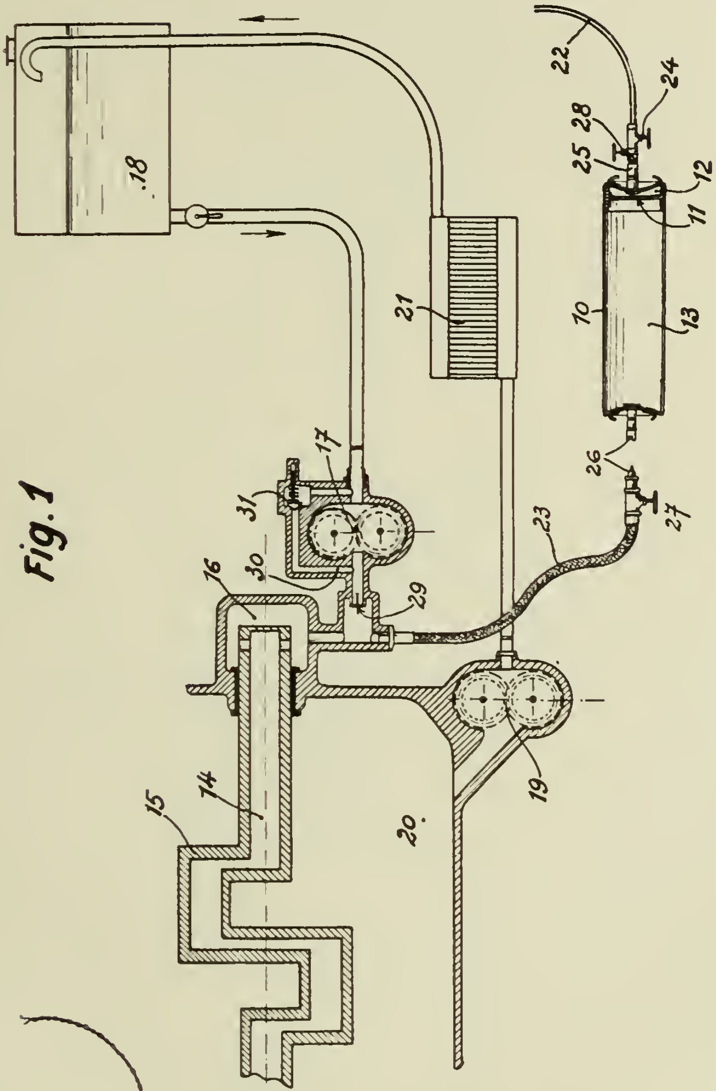
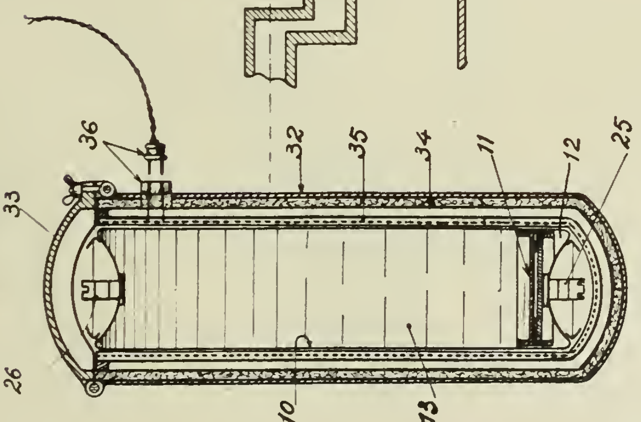


Fig. 2



Inventor
Emile Piquerez
By Sommers & Young Attys

PUBLISHED
JUNE 15, 1943.
BY A. P. C.

E. PIQUEREZ
LUBRICATION OF AERO AND OTHER ENGINES
Filed Dec. 16, 1938

Serial No.
246,211
3 Sheets-Sheet 2

Fig. 3

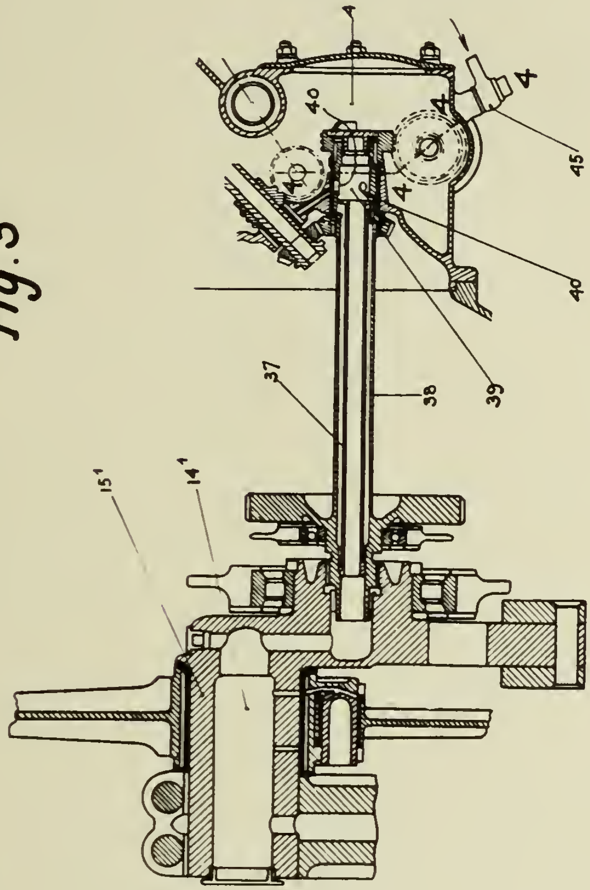
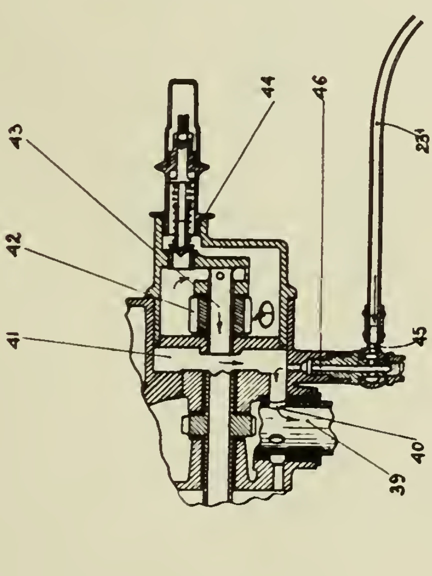


Fig. 4



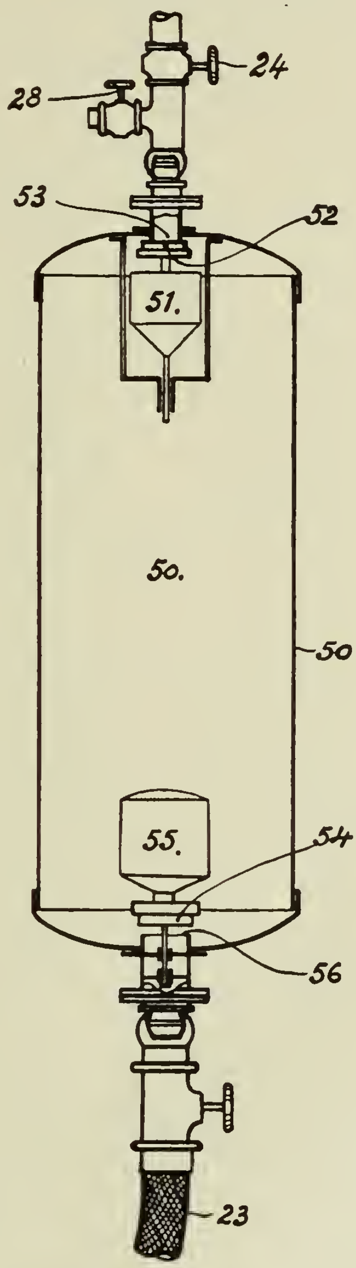
Inventor
Emile Piquerez
By Sommers & Young
Attys

PUBLISHED
JUNE 15, 1943.
BY A. P. C.

E. PIQUEREZ
LUBRICATION OF AERO AND OTHER ENGINES
Filed Dec. 16, 1938

Serial No.
246,211
3 Sheets-Sheet 3

Fig. 5



Inventor.
Emile Piquerez
By Sommers & Young
Attys

Published June 15, 1943

Serial No. 247,661

ALIEN PROPERTY CUSTODIAN

PROCESS FOR TREATMENT OF METALLIC SURFACES

Rene Marie Berthier, Chambery, France; vested in the Alien Property Custodian

No Drawing. Application filed December 24, 1938

It is known that by the passage of a continuous current anodic effects are produced on metallic surfaces plunging as electrodes into an electrolytical bath. Thus it is possible to dissolve metallic surfaces or a metal deposited on a supporting metal, to produce a protecting oxidized layer or to achieve a cleansing and even an electrolytical polishing or brightening.

We have found that these effects of the electric current may be obtained without the help of the electric current by addition to a bath which can work with the electric current to produce a given anodic effect, at first of well chosen oxidizing compounds, then of stabilizing substances and at last of various matters facilitating the chemical process or improving the result. As oxidizing compounds are preferably chosen those compounds the reduction products of which are colourless and soluble and that easily undergo a reoxidation in order to secure the regeneration of the baths. If one of these oxidizing compounds to be added yields reduction products that are insoluble or coloured and if the anodic effect is to give a protecting layer, it will be possible to realize peculiar colouring effects and the strengthening of this layer.

This anodic effect may also to be cause of a redressing effect as also of a condensation effect. Electrolytes containing ferricyanides, manganicyanides and cobalticyanides and analogous complex compounds are particularly suitable to make up condensation or redressing electrolytes.

The oxidizing compounds may still be partly or wholly present in the electrolytic bath. In such a case the present invention foresees the utilisation of the same bath without current and if necessary in presence of some additional substances.

It has been observed, moreover, that the electrolytical baths modified as has been said previously in order to be capable of working without current, may in their turn act as electrolytes and simultaneously produce both electrolytical and chemical effects.

The regeneration of the exhausted baths is generally achieved by a chemical reoxidation as for instance by means of oxygen or compressed ozone applied under pression or without any pression or in some electrochemical way. Examples will be given farther.

It has been observed that in some cases it was useful to add to the bath some very small amounts of a catalytic agent such as a cerium salt or when the bath is an alkaline one the catalyst may be a halogenated salt.

Examples

1°—The detining of tin-plate which may be achieved by anodic attack in an alkaline bath will be easily completed by the action of an alkaline solution containing an oxidizing compound as for instance a ferricyanide or simply by oxygen or air dissolved under pression or without any pression. The supporting iron will remain inattacked. The same is true for the removal of zinc covering galvanised iron as also for the removal of a lead-coating the supporting metal being iron.

2°—The realization of a protecting anodic layer on aluminium and its alloys by means of electrolytical baths containing sulfuric ions or hydroxyl groups is well known. If a soluble ferricyanide as for instance an alkaline ferricyanide is added to a bath made up of sulfates and if this bath is alkalinized by means of soda in order to secure the stability of the ferricyanide compound, an excellent protecting coating is then realized by a chemical effect. If a soluble ferricyanide as for instance an alkaline ferricyanide is added to an alkaline carbonatic bath capable of producing an anodic effect, the protecting coating achieved in a chemical way will be inferior to that realized in the foregoing case. Good results may also be achieved in these baths by adding various salts other than sulfates.

With sulfates, for instance, it is probable that the process is as follows: the ferricyanide draws to itself the alkaline metal of the sulfate and sets in liberty the sulfuric ion. This sulfuric ion acts then on the metal in the same manner as in the case of the anodic effect by forming a sulfate of this metal which undergoes a hydrolisis and combines with the carbonate of the bath in order to give, on the one hand, an oxide on the metal and, on the other hand, an alkaline sulfate and carbonic acid. The practise has shown what salts act in these baths in the same way as the sulfate does. We may particularly mention acetates and nitrates. Some compounds such as fluorides and fat acids hinder the reaction and their presence in the bath must be avoided.

Some other compounds such as chlorides, bromides, iodides produce localized effects and must also be avoided. Yet traces of these salts are useful and act as catalysts.

Our practise has shown that the bath must not be too alkaline and the alkalinity is regulated by means of some bicarbonate or carbonic gas.

Similarly results may be achieved by using instead of ferricyanide some oxygen or air dissolved under pression or without applying any pression. Some examples of the bath compositions are given here below:

		G.
(1)	Potassium ferricyanide	260
	Solvay soda	72
	Sodium sulfate	33
	Sodium acetate	12
	Sodium bicarbonate	1

Tap water, to make up 1 l.
Temperature: 70–80° C. Duration: 1 hour.

		G.
(2)	Potassium ferricyanide	150
	Solvay soda	40
	Sodium sulfate	18
	Sodium acetate	7
	Sodium bicarbonate	2

Tap water, to make up 1 l.
Temperature: 70–80° C. Duration: 1 hour.

		G.
(3)	Potassium ferricyanide	26
	Solvay soda	8
	Sodium sulfate	25
	Sodium acetate	1
	Sodium bicarbonate	1

Tap water, to make up 1 l.
Temperature: 80–90°. Duration: $1^h\ 30'$.

The bath while working becomes impoverished in ferricyanide and on the other hand it grows rich in ferrocyanide bicarbonate and dissolved alumina.

The most practical regeneration process is in this case the electrolytical treatment which may be realized in an intermittent manner or in a continuous way, in the treatment vat or in a special apparatus. The electrolysis is realized by means of an anode which may be made up of lead, graphite, iron or nickeled iron having a surface as great as possible, and by means of an iron cathode having a very small surface and which may be introduced into a porous vessel. We must take care of securing a certain stirring of the liquid. It is profitable to add some ferrocyanide to the bath and to stop the reoxidation when a suitable content in ferricyanide is attained.

In order to eliminate alumina and silica suspended or dissolved in the bath, it is convenient to cool the bath and to filter what may be done in an intermittent or in a continuous way.

We give here below some details about the composition of the baths: potassium carbonate tends to produce dull coating-layers while the tendency of sodium carbonate is to give transparent and bright coating-layers. Sulfates give rather transparent and bright coating-layers; acetates produce stronger, thinner and duller coating-layers.

The alkaline substance of these baths must not necessarily be a corbonate; it may also be, for instance, a borate.

The obtention of bright coating-layers on aluminium and its alloys in an electrolytical bath made up of sodium sulfate and alkalinized by means of soda is well known. By addition to this bath of an alkaline ferricyanide it is possible to achieve the same effect.

We give here below a formula indicative of the composition of the bath:

	G.
Potassium ferricyanide	180
Sodium sulfate	180
Sodium hydroxide	20

Temperature: 80° C. Duration: 5 minutes with stirring.

A bath of this kind may also serve for zinc, tin and their alloys. The chemical bath used as electrolytical bath yields a brighter coating-layer than that realized with the primitive electrolytical bath the current density being less high.

Instead of soda use may be made in the foregoing compositions of every strongly alkaline substance that is compatible with the oxidizing compound: alkaline phosphate, borate and so on. Instead of the sulfate use may be made of other salts: oxalate, acetate and so on.

In the foregoing examples mention has been made of ferricyanides acting as oxidizing compounds, but other oxides may also be used such as—in acid baths—peroxygenated acids, perchloric, permanganic, chromic, persulfuric, nitric, picric acids and their salts, the salts of metallic peroxides such as the salts of cerium peroxide and so on, dissolved oxygen, hydrogen peroxide.

In alkaline baths: the foregoing salts, peroxygenated hydrates such as those of sodium and potassium, complex salts such as ferricyanides, manganicyanides, cobalticyanides, sulfocyanides, the oxygenation products of organic reducting compounds and more particularly of photographic reducing substances, dissolved oxygen, hydrogen peroxide and so on.

The baths may also receive addition of auxiliary substances: coagulating electrolytes such as polyvalent ions when protecting layers are to be realized, catalysts, moderating substances and so on.

The surfaces treated by these processes in order to achieve a bright coating or protecting layer may also be followed by the complementary treatments in use in analogous cases and more particularly by a brightening, a discoloration, a treatment with mordants, a dyeing, a fixing treatment, a sealing, an impregnation achieved more particularly by fat compounds and fat acids, a precipitation achieved by the reaction with an inorganic compound and so on.

The discoloration of layers coloured by oxides will be realized, for instance, by means of cyanide baths, sulfite or sulfitocyanide baths.

The processes according to our invention may also constitute a stage of a more complex process. It may for instance be used to cleanse surfaces to be submitted to a subsequent anodic oxidation. By means of these processes it is also possible to achieve a bright or transparent oxidized layer that is liable to be dissolved in order to give a cleansed, smooth, or even a bright metal. In such a case the solvents which may also be used to dissolve unsatisfactory layers are chosen according to the nature of the oxidized layer. Thus if this layer is constituted by an aluminium oxide we may use concentrated cold sodium bisulfite or concentrated, hot, green chrome sulfate or one of the following substances: acides and more particularly concentrated acides, acid salts, neutral salts such as acetates, oxalates, tartrates, acid salts obtained by hydrolisis, complex salts such as concentrated green chrome salts, ferro-

cyanide, boron and sodium double tartrate, alkaline salts such as alkaline phosphate, alkaline compounds such as soda and more particularly high concentrated soda at 40°, concentrated potassium carbonate, concentrated ammonium, methylamine, methylammonium hydrate. The action of these substances upon the metal may eventually be lessened by an addition of inhibiting compounds such as silicate, chromate and so on.

The applying of such processes to goods of every kind constitutes a part of our invention.

RENÉ MARIE BERTHIER.

Published June 15, 1943

Serial No. 247,986

ALIEN PROPERTY CUSTODIAN

MANUFACTURE OF RUBBER POWDERS, RUBBER DISPERSIONS, EBONITE POWDERS AND THE LIKE

Jan Willem Van Dalfsen, Buitenzorg, Java, Netherlands East Indies; vested in the Alien Property Custodian

No Drawing. Application filed December 27, 1938

The invention relates to a process for the preparation of a rubber powder and the like from latex.

Several processes are already known in which from latex rubber can be obtained in granular, crumbly or powdery form.

These known processes can be divided in four groups, namely:

1. Processes in which latex is atomised in a drying atmosphere. Although the rubber powder obtained in this way sticks together, by adding certain substances to the latex which is to be atomised, a film of non-sticking substances can be formed round every rubber particle during the drying operation.

The powder to be obtained in this way contains normally at least 10 parts of foreign substances on 100 parts of rubber. Moreover these processes meet serious difficulties by application on a technical scale so that they have not yet come to a technical development.

2. Processes in which drops of latex are caught on a moving surface, each drop being dried separately to a rubber particle, which particles are removed from the moving surface, if necessary after having been sprinkled with a substance which prevents sticking of the rubber. Any further reducing by grinding or rolling the crumbs or grains obtained in this way is impossible or hardly possible.

3. Processes in which the latex used as starting material is converted into a granular non-coherent coagulum or flocculate, which after being separated by passing through a sieve or centrifuging is dried to crumbs or grains. Quite different processes are known to obtain a granular non-coherent coagulum. This can be performed by adding to the latex large quantities of certain solid substances and coagulating subsequently.

The drawback of these processes is that powders are obtained, which nearly always contain considerable percentages of foreign substances, this giving difficulties for several applications.

4. Processes in which a coagulum is obtained by coagulating latex, to which sodium-nitrite is added (if desired in the presence of substances, which affect the coherence of the coagulum). The crumbly rubber thus obtained is a modified rubber, because the rubber itself has undergone changes. This crumbly rubber has properties which are different from those of other powdery or crumbly rubbers. In many cases these diverging properties will be a handicap when applying these products.

The known processes for preparing a finely divided rubber present therefore serious drawbacks: there are processes which on technical application yield difficulties, which hitherto could not be overcome, while the other processes lead to crumbly or granular products which cannot, or can hardly, be further reduced, or to a fine powder, which however nearly always contains a considerable percentage of foreign substances, or to products wherein the rubber has properties differing greatly from those of the raw rubber.

According to the present invention it is possible to obtain a rubber powder, which contains a very small amount, at the most 5%, of added solid substances and which, if necessary, can further be reduced by grinding. The powder prepared in this way is not in the least sticky and is not affected by moulds, bacteria or moisture, and in consequence of these extraordinary properties, it can be shipped in bales.

In order to obtain this result, sulphur or other vulcanising agent, zinc oxide or other activator of the vulcanising agent and one or more stabilisers are added to the latex, after which either the mixture is left alone for a long period or—to accelerate the reaction—the mixture is heated. During this period the reaction is investigated at intervals either by desiccating small samples of the mixture to a film and measuring its tensile strength, or by coagulating these samples in a known way, for example by adding acid, after which the coherence of the coagulum is determined each time. The surprising effect is then observed that the tensile strength of the films decreases gradually, while the coherence of the coagulum also diminishes. Finally a moment is reached when the tensile strength of the film becomes zero, or at least very small, while the second test also shows that the coherence of the coagulum has disappeared. At this moment the reaction is stopped in order to proceed to the separation of the rubber from the liquid.

This separation can be performed in several ways, for example by coagulation, by means of acids or salts or in any other known way, after which the powdery coagulum is separated from the liquid by filtration or centrifuging or in another way.

A second method of carrying out this separation is to pour out the liquid in thin layers, to permit the water to evaporate and to disintegrate the films obtained in this way, for example by grinding.

It is also possible to separate the rubber as a

dry powder by spraying or atomising the liquid in a drying atmosphere.

Finally it is also possible to allow the ready latex mixture to trickle upon a moving surface and then to desiccate it on this surface.

By also adding vulcanising accelerators to the latex the process can be accelerated, or performed at a lower temperature.

As far as needed, fillers, or so-called softeners, or anti-oxidants or colorants or odorants or means to raise or to reduce the viscosity or the surface tension can also be added to the latex, separately or together.

It was found that when fresh latex was used, and if precautions, to be mentioned below, are taken into consideration, the course of the reaction is different and the final state according to the invention is arrived much sooner than in case that old preserved latex was used under the same conditions.

This acceleration of the reaction of fresh latex with respect to that of old preserved latex occurs if the hydrogen ion exponent (pH) of the mixture, the reaction temperature, the vulcanisation accelerator and the concentrations of the reacting substances are chosen in such a way that no decomposition (or only a very small one) of the proteins of the fresh latex takes place.

It is known that in old preserved latex the protein compounds which are by nature present in latex, are no more in the original state, as, in consequence of the alkality of the medium and possibly also in consequence of the action of enzyms or bacteria, they have undergone a hydrolysis and a decomposition. The mentioned acceleration of the reaction according to the invention should therefore only be able to take place with old latex, if it were possible to effect the conservation process by adding a non-alkaline reacting substance.

As during the reaction according to the invention alkaline stabilisers have to be added, the reaction conditions should preferably be chosen in such a way that the undesired by-reaction, namely hydrolysis and decomposition of the proteins in consequence of the alkaline medium, does not domineer over the desired reaction.

To obtain this result the pH of the latex mixture should preferably be chosen as low as possible, as far as this does not endanger the stability of the latex mixture, while the reaction temperature should preferably not surpass 90° C and preferably an ultra vulcanisation accelerator is added. Examples of a favorable choice of the reaction conditions are given below.

As it has also appeared that the industrially important properties of the rubber powder to be obtained according to the invention are better if fresh latex is used as starting material, the reaction being carried out while taking into consideration the above mentioned conditions, it is also for this reason that one should start from fresh latex.

The remarkable properties of the rubber powder to be obtained according to the invention, and also the difference in the course of the reaction with fresh latex and old preserved latex must perhaps be explained from the formation of compositions between the protein compounds of the latex and the added reactants. This was shown by the results of comparative tests with fresh and old latex and with latices, wherein the protein compounds had been more or less removed in an artificial way, by application of repeated creaming or repeated centrifuging.

In accordance with the above-mentioned hypotheses is also the fact, shown by chemical analysis, that the new form of rubber contains combined sulphur, but also is capable of normal vulcanisation, also in the absence of free sulphur. This vulcanisation can be obtained by heating the very delicate rubber film, obtained by the process according to this invention, for some time at vulcanisation temperature. In this way it acquires a high tensile strength, as appears from the experiment described below.

As therefore a normal vulcanisation is necessary to give the properties of vulcanised rubber to the rubber obtained according to the invention, the rubber powder cannot be vulcanised in the sense which, until now, was attached to this word; neither can the latex mixture obtained according to the invention, at the moment, the stage has been reached in which the separation of the rubber is started, be called a vulcanised latex.

Substances which are present in the resulting rubber powder and which are for any reason undesirable, can be removed in a physical or chemical way.

If the rubber powder, obtained according to the invention, is dispersed in water or an aqueous liquid, for example a salt solution, which can be effected easily in any mixing apparature, a ball mill being particularly suitable, an artificial latex is obtained in which, on microscopic investigation, particles are found of the size of the original latex particles. This method of preparing an artificial latex yields the possibility of greatly economising the transport costs of latex.

Also it is very easy to disperse the rubber powder, prepared according to the invention, in a rubber solvent, thus obtaining a dispersion which on microscopic inspection appears to consist of rubber particles of the original latex, but in a swollen state. It is remarkable that the swollen particles are not sticky; on pulverising the particles, a non-sticky paste is obtained of a very high rubber concentration.

By applying the new process to a latex mixture containing at least 20 parts of sulphur to 100 parts of rubber, a powder is obtained which can be vulcanised by an additional heating to an ebonite mass, which has practically no coherence and therefore is very easily disintegrated to a so-called ebonite powder.

This process means a simplification with respect to the American patent letter 1,849,920 which describes a process for the preparation of ebonite powder by heating latex for 8 to 10 hours under pressure at 141,5° C with 30 to 100 parts of sulphur, if desired in the presence of fillers.

By separation of the rubber from the heated mixture ebonite is obtained, which, if necessary, can be further disintegrated. As it is known, this process cannot be carried out at lower temperature, so that the application is bound to the use of autoclaves.

According to the new process a powder can be obtained by heating the latex below 100° C., after which the vulcanisation to ebonite may be effected by heating to about 140° C., which however not necessarily has to take place in an autoclave.

Therefore the new process can be applied with a much simpler apparatus.

If the rubber powder is formed by coagulation of the pre-treated latex mixture containing an accelerator, it is advisable to perform this coagulation with salts or in a mechanical way, for example by stirring or shaking very quickly, so

as to preserve the vulcanisation accelerator, which ordinarily is affected by acids.

Example 1

The starting material employed was a one day old Hevea plantation latex to which ammonia was added immediately after tapping.

Analysis of the latex gave:

Dry rubber content ________ per cent__	35.9
Total dry substance content ________ do____	38.8
Ammonia content ________ grams per litre__	1.3

From this latex a mixture was compounded which contained per 100 parts rubber:

	Parts
Zinc oxide____	1
Sulphur ____	2
The vulcanisation accelerator "Vulcafor SDC" ____	1

These chemicals were ground in a ball mill for for 12 hours, while to the said 4 parts of mixture were added:

	Parts
A 10% ammonia-caseinate solution____	2
Water ____	6

This dispersion of chemicals was added to the latex while stirring thoroughly.

The latex mixture was then heated to a temperature of 80° C. during increasing periods, at the end of which each time in one portion of the latex mixture the structure of the coagulum was determined, which was effected by addition of formic acid, while another portion was poured out each time on horizontal glass plates. On desiccating by evaporation at normal tropical temperature (26°–30° C.) films were obtained on the glass plates, and the tensile strength, the elongation at rupture, and the stiffness (the tensile strength to effect an elongation of 600%) of the films were determined on a stretching machine (all measured in kilograms per cm^2).

The results were as follows:

Table No. 1

Test	Duration of heating	Structure of the coagulum	Stiffness of the film	Tensile strength	Elongation at rupture in percent	Percent combined S calculated on dry rubber
a____	Not heated	Normal____	7	25	982	0.5
b____	1 hour____	____do____	5	20	1090	0.6
c____	2 hours____	____do____	13	29	833	0.7
d____	3 hours____	Coherent but non-elastic.	____	12	505	1.0
e____	4 hours____	Grandular, noncoherent.	____	7	223	1.4
f____	5 hours____	____do____	____	0	0	1.6

strength was determined once more; these data are collected in table No. 2.

Table No. 2

Heating		Stiffness	Tensile strength	Elongation at rupture
Temp.	Duration			
°C.	*Minutes*			*Percent*
110	45	36	178	813
110	60	35	177	802
110	90	39	179	817
110	135	32	192	836
110	180	35	186	831
150	5	27	213	943
150	15	15	212	1068
150	20	16	206	1062
150	25	14	170	1073
Unheated film___		____	7	223

Example 2

In order to show that the desired effect is also obtainable by leaving the latex mixture at rest at normal temperature, the following tests can be effected, in which a mixture with about the same composition as that of the mixture above described was kept for 28 days at ordinary temperature, after which a brittle state of the rubber film was attained. Tests made during that period gave the following results:

Table No. 3

Days kept	Mechanical stiffness while streching 600%	Properties of the film	
		Tensile strength	Elongation at rupture
0____	____	____	____
1____	2	3	896
2____	4	12	984
3____	6	20	970
4____	8	31	982
5____	10	38	971
7____	15	41	904
10____	20	44	810
14____	21	36	723
21____	26	29	625
28____	(1)	____	____

1 Film is brittle.

From test *c* a rubber is obtained by desiccating as well as by coagulation, which cannot be ground to a powder without a very great consumption of energy. From test *d* a rubber is obtained, which, when wet, can be comminuted with a moderate consumption of energy. From test *e* a powder is separated by filtering the granular coagulum, then drying it and passing the dry powder through a beating mill. The films obtained from test *e* by desiccation by evaporation can very easily be ground, for example in a meat mill or a mill comprising crosswise arranged beating means.

In order to prove that the rubber obtained from test *e* is not vulcanised in the normal sense of the word, the films, which during this test had been obtained by desiccation by evaporation, were heated for increasing periods to 110° C. and to 150° C. After this additional heating the tensile

Moreover the films were submitted to some other vulcanisation tests, after which also the free sulphur was determined. The results are collected in the following table:

Table No. 4

Age of the latex mixture	Minutes vulcanised at 90° C.	Properties of the film		
		Free sulphur in the rubber	Tensile strength	Elongation at rupture
Days		*Per cent*		
28	____	0.76	(2)	(2)
28	20	0.50	93	640
29	45	0.35	165	615
30	90	(1)	152	628
33	____	0.69	____	____

1 Not determined.
2 Brittle.

Example 3

As starting material a latex was taken which had been tapped the same day and which on analysis appeared to have the following properties:

Dry rubber content	per cent	40
Total dry substance content	do	42.9
Ammonia content	grams per litre	6.1

From this latex a mixture was prepared, containing per 100 parts rubber:

	Parts
Zinc oxide	2.0
Sulphur	40.0
Vulkacit F extra N	0.8

The dispersion of the chemicals was made in the same way as described in Example 1.

The mixture of latex and chemicals was heated to 80° C until in a sample, a granular non-coherent coagulum was formed on coagulating with formic acid, which was the case after a heating for three hours. Then the whole mass of the mixture was coagulated by addition of a solution of aluminium chloride. No real coagulation took place, but a highly viscous dispersion of flocculated particles was formed. As the size of the particles was so small that centrifuging or filtering presented difficulties, the mixture was desiccated in a vacuum oven. In this way a powder was formed which could be easily ground still further. Thereupon the dry powder, without application of pressure, was further vulcanised by heating it for 2 hours at 150° C, through which after some disintegration an ebonite powder was formed, which was sifted immediately. Each sieving fraction could very easily be disintegrated still further.

The fine rubber powder obtained according to the new process is applicable advantageously for mixing with asphalt for road purposes; it furnishes a good raw material for the preparation of rubber derivatives, and it can also be applied, for example, in the form of ebonite moulding powder to the manufacture of pressed and moulded articles, for which purpose the powder can be used alone or mixed with other substances, for example, synthetic resins.

JAN WILLEM VAN DALFSEN.

Published June 15, 1943 Serial No. 251,044

ALIEN PROPERTY CUSTODIAN

AQUEOUS EMULSIONS AND A PROCESS OF PREPARING THEM

Werner Starck, Hofheim, (Taunus), and Heinrich Freudenberger, Frankfurt am Main-Nied, Germany; vested in the Alien Property Custodian

No Drawing. Application filed January 14, 1939

This application is a continuation-in-part of our co-pending U. S. Application Serial No. 49,642 filed November 13, 1935.

The present invention relates to aqueous emulsions and to a process of preparing them.

Processes are known for the manufacture of aqueous suspensions or emulsions of polymeric vinyl esters. As emulsifying agents there have been used soap-like emulsifying agents or wetting agents or both, such as have been known for dispersing hydrophobic substances in water, for instance for the manufacture of emulsions of oil in water. Now it has been found that if such emulsifying agents, for instance sodium oleate or sodium 12-hydroxy-octadecane-1-sulfonate, are used during the polymerization of vinyl esters, as emulsions of the polyvinyl esters are obtained, the size of the particles of which lies below 0.2μ, i. e. the particles of which can no longer be detected by the ordinary microscope but only in the ultra-microscope by the Tyndall-effect. Finely dispersed emulsions of this kind have various drawbacks in industry: on the one hand the emulsions are very thinly liquid, i. e. they cannot be spread in the manner possible for a solution having the same concentration of the polymeric body in an organic solvent; furthermore, these finely dispersed emulsions are not stable and tend to coagulate on addition of electrolytes, pigments and other adjuvants; on the other hand the large surface of the dispersed phase affords an extensive front for the attack of the dispersing agent (water) which readily leads to a chemical alteration of the polymeric body. In emulsions from polyvinyl acetate prepared in the presence of soaps, for instance, the polyvinyl ester is saponified after a short time, the reaction being accelerated by the emulsifying agent having in most cases a feebly alkaline and, therefore, ester-cleaving action.

On the other hand granular or spherical polymerizates from vinyl esters have been made in aqueous solutions of water-soluble compounds having a high molecular weight, for instance water-soluble cellulose derivatives, starch, polyvinyl alcohol and the like. In this process polymerizates are obtained the size of the particles of which lies between 0.025 and 2.5 millimeters. The polymerizates separate from the liquor and therefore may be filtered after their preparation. The water-soluble adjuvant substances of high molecular weight therefore are only of an intermediary importance during the polymerization process.

Now we have found that stable and viscous emulsions of high percentage strength and capable of being spread may be obtained from polyvinyl esters by polymerizing the vinyl esters in aqueous solutions of polyvinyl alcohol, the viscosity of the solutions being at least 20 centipoises. On further investigating this process it has been found that emulsions of polyvinyl esters are obtained the size of the particles of which lies between about 0.5 and about 10μ. These emulsions are stable for an unlimited time and have, if they contain, for instance, 50–80 per cent. of polymeride, a consistency capable of being spread, like concentrated natural latex. The particles of such emulsions can be seen under the microscope and exhibit Brownian movement; when obtained according to this method of operating, therefore, as regards their order of magnitude, they are between those obtained by the two known processes described above.

During this method of polymerization the polyvinyl alcohol acts during the polymerization process not only as an emulsifying agent but also as a protective colloid for the polymeric product formed and hinders the sedimentation of the particles. For the manufacture of emulsions from vinyl esters having the size of particles described above, for instance 100 parts by weight of vinyl acetate, are heated, while stirring, in 100 parts by weight of an aqueous solution of 5 per cent strength of polyvinyl alcohol having a viscosity of 140 centipoises, while applying catalysts of the peroxide series, such as hydrogen peroxide. The same effect, however, is obtained when applying isoviscous solutions of a higher or lower polymeric polyvinyl alcohol. During this process it seems to be suitable to use solutions of low concentration of 20–250 centipoises viscosity, of a polymeric polyvinyl alcohol as highly polymerised as possible in order to maintain the portion of the water-soluble component in the finished emulsion as low as possible. During the polymerization the mixture is suitably maintained feebly acid by the addition of small quantities of organic acids. Thereby the polymerization process is accelerated; in this manner the time during which the monomeric vinyl ester remains in the aqueous dispersion phase is reduced to a minimum.

Instead of polyvinyl alcohol or a mixture comprising polyvinyl alcohol there may be used the water-soluble derivatives of the polyvinyl alcohol, for instance a polyvinyl alcohol the hyroxyl groups of which were partly transformed with aldehydes into acetal-like products. Such aldehydes are for instance formaldehyde, acetalde-

hyde, propionaldehyde, butyraldehyde or isobutyraldehyde. There are furthermore useful the water-soluble, partially saponified esters of polyvinyl alcohol with organic carboxylic acids, for instance partially saponified polyvinyl formate, polyvinyl acetate, polyvinyl propionate or polyvinyl butyrate.

There may be polymerized the vinyl esters of organic carboxylic acids, for instance vinyl formate, vinyl acetate, vinyl propionate, vinyl butyrate, vinyl chloracetate, vinyl methoxacetate or vinyl ethoxacetate, or mixtures of these esters. The esters may also be polymerized in mixture with other compounds yielding interpolymerization products together with said esters, for instance with vinyl chloride, acrylic acid methyl ester and acrylic acid ethyl ester, methacrylic acid methyl ester and methacrylic acid ethyl ester, maleic acid dimethyl ester and maleic acid diethyl ester, furmaric acid dimethyl ester and furmaric acid diethyl ester, crotonic acid methyl ester and crotonic acid ethyl ester.

The polymerization may be carried out in the usual manner, for instance at a temperature between room temperature and about 100° C. As catalysts there are useful potassium persulfate, sodium persulfate or ammonium persulfate; potassium perborate, sodium perborate or ammonium perborate; hydrogen peroxide. These catalysts are added to the aqueous medium. Organic peroxides, such as benzoyl peroxide, may be used simultaneously or alone; they are preferably dissolved in the monomeric compound to be polymerized.

Softening agents, filling agents or other effect substances may be added to the emulsions before, during or after the polymerization.

The viscosities of the aqueous solutions may be determined in a ball viscosimeter according to Höppler. The viscosity determinations relate to a temperature of 20° C.

The following examples serve to illustrate the invention, but they are not intended to limit it thereto, the parts being by weight:

1. 0.4 part of lactic acid and 1 part of potassium perborate are dissolved in 400 parts of an aqueous polyvinyl alcohol solution of 6 per cent strength having a viscosity of about 140 centipoises. This solution is heated to 80° C–85° C in a stirring vessel provided with a reflux apparatus and 600 parts of vinyl propionate are introduced, while well stirring. Polymerization sets in, accompanied by strong boiling and evolution of heat. The reaction is finished when the reflux ceases and the temperature decreases. A highly viscous emulsion capable of being spread and of a good stability is obtained. The emulsified particles have the size of about 1–2 μ.

2. 1 part of formic acid and 2 parts of hydrogen peroxide of 30 per cent strength are dissolved in 1000 parts of an aqueous solution of 5 per cent strength of polyvinyl alcohol, having a high molecular weight, and a viscosity of about 150 centipoises. This solution is heated in an enameled stirring vessel provided with a reflux apparatus to 65° C–70° C, while well stirring. 1000 parts of vinyl acetate are then introduced in a slow current. During the strongly exothermic reaction the temperature increases to 93° C. After the polymerization reaction is terminated, i. e. when the temperature in the interior of the vessel decreases, the whole is further heated for one hour at 80° C–85° C. After cooling a highly viscous, stable emulsion capable of being readily spread is obtained. The dispersed particles have a diameter of 0.5–1 μ.

3. 0.75 part of glacial acetic acid and 2 parts of hydrogen peroxide of 30 per cent strength are dissolved in 500 parts of an aqueous solution of a low viscous polyvinyl alcohol of 10 per cent strength containing 7 per cent of acetyl groups and having a viscosity of about 80 centipoises. The solution is heated as described in the foregoing examples. A mixture of 400 parts of vinyl acetate and 100 parts of vinyl-butoxy-acetate is then introduced. After the polymerization is terminated a stable emulsion is obtained which when dried, for instance upon textile fabric, leaves an elastic film.

4. 1.2 parts of formic acid and 2 parts of hydrogen peroxide of 30 per cent strength are added to 1000 parts of an aqueous solution of 40 per cent strength of polyvinyl alcohol containing 6 per cent of acetalydehyde groups in an acetal-like linkage and having in a solution of 4 per cent strength a viscosity of about 25 centipoises. This solution is mixed in a vessel, while rapidly stirring, with 1000 parts of vinyl acetate. A stable emulsion of monomeric vinyl ester is obtained in the aqueous phase. This emulsion is allowed to run from a reservoir into an enameled vessel heated to 80° C. The velocity of admission is suitably determined according to the course of the polymerization reaction. After the reaction is finished a creamy emulsion is obtained the particles of which have a size of 1–3 μ.

WERNER STARCK.
HEINRICH FREUDENBERGER.

Published June 15, 1943

Serial No. 251,010

ALIEN PROPERTY CUSTODIAN

APPARATUS FOR TESTING VEHICLES

Emile Piquerez, Saint-Cloud, France; vested in the Alien Property Custodian

Application filed January 14, 1939

This invention relates to apparatus for checking motor and other vehicles and has for its object the provision of apparatus for the rapid checking of such vehicles in order to determine that they comply with the conditions essential for their safe operation.

This apparatus comprises, for the purpose of checking the brakes of the vehicle, an inclined track a delimited part of which affords a maximum grip to the tyres, and means for comparing the time taken by the braked vehicle to descend the said part of this slope, under its own weight, with a predetermined standard time and for indicating automatically the result of this comparison to give an automatic indication of braking efficiency. Good braking is shown when the actual time taken by the vehicle is equal to or greater than the standard time, while bad braking is indicated when this time is less than the standard time.

The comparing and indicating means associated with the defined checking or testing path on the said track comprise, according to one embodiment of the invention, a device for measuring the standard time, means operated by the vehicle passing the starting point of the test path for starting the operation of this time measuring device, an indicating device adapted to be operated by the measuring device under particular conditions, means operated by the vehicle crossing the end point of the test path for modifying the operating conditions of the indicating device, and means for rendering the aforesaid means inoperable at the end of the operation of the measuring device.

The comparing and indicating means associated with the test path can be mechanical or electro-mechanical. Moreover, the indicating arrangement can be arranged to convey the result of the test either by a signal, in the form of a recording or in both of these ways.

One embodiment of the invention of the electro-mechanical type giving the result of the test as a signal comprises a contact arranged at the start of the test path and adapted to be operated by the vehicle to cause in combination with a time switch or equivalent device, the appearance of a signal of predetermined length, and a second contact at the end of this path also adapted to be operated by the vehicle and adapted to cause the disappearance of the said signal, the observation of the disappearance of the signal before the crossing of the second contact indicating that the result of the check or test is satisfactory, while the continuance of the signal after the crossing of the second contact shows that the result is unsatisfactory.

In another embodiment, also of the type in which the result is indicated by a signal, which can be visual or aural, the apparatus comprises, as before, two contacts arranged at the beginning and end of the test path respectively, the first contact being adapted, in combination with a time switch, to cause the appearance or emission of a signal of a length equal to the standard time, and the second contact being adapted to cause the disappearance of this signal and the appearance or emission of a further signal, indicating that the result of the test is unsatisfactory if this contact should be operated at the end of a time less than the standard time.

The indication of the result of the check can be furnished, as has been stated above, by an apparatus operating as a recorder which may be provided in conjunction with or instead of one, such as that just described, operating to give a signal.

The apparatus can thus comprise a registering device connected to two contacts arranged at the beginning and end of the test path, which contacts can be the same as those referred to above, this device, in combination with a time control and an inscribing apparatus giving the result of the comparison between the actual time taken and the standard time by writing a conventional sign on a card.

An embodiment of the apparatus indicating by registration can comprise an electro-magnet adapted to be energised by the contact at the end of the path, which electro-magnet is provided with an armature connected to a reglet carrying conventional characters such as "G" (Good) or "B" (bad) which reglet normally presents the character "G" in front of a striker, such as a plunger, provided with operating means adapted to cause the plunger to strike this character at the end of the standard time and thus to produce the impression of this character on a suitable carrier, such as a paper band arranged in front of it, when the actual time taken by the vehicle to cover the path is greater than the standard time. On the other hand, if the electro-magnet is energised by the said contact before the end of the standard time the armature of the electro-magnet moves the reglet into a position such that the character "B" is in front of the said striker, so that the character "B" is then impressed in place of the character "G". An arrangement is provided for maintaining the reglet

in this second position at least until the end of the standard time.

In an advantageous embodiment the operating means of the plunger can comprise a cam set in rotation as a result of the closing of the first contact, that is to say of the contact situated at the star of the test path, which cam is arranged to stress and to unstress, at the end of a uniform rotation time equal to the standard time, a spring adapted to ensure the striking of the said plunger on the reglet carrying the conventional characters.

The said cam and its operating means can be arranged in such a way that this cam makes one complete turn at a uniform speed during the standard time.

According to another particularly advantageous arrangement, use is made of a continuously rotating disc and a magnetic plate adapted to be magnetically coupled to this disc, upon the energisation, through the first contact, of an electro-magnet in this magnetic circuit of which the plate is included. This plate is attached to the said cam which is thus driven by the disc. A return spring is provided to return the said cam to its rest position upon the uncoupling of the plae from the disc, which uncoupling coincides with the breaking of the circuit of the electro-magnet by a time switch.

In another embodiment the striker of the printing device can be arranged to be loaded directly by an electro-magnet energised through the contact at the start of the path and a time switch started by the latter, while the electro-magnet operating the reglet in order to prepare it for the impression of the character "B" is arranged to be energised, in dependence on the time switch, by a contact established by a relay under the action of the contact at the end of the path. Another contact broken immediately afterwards by the same relay effects the opening of the circuit of the first said electro-magnet, and is also dependent on the time switch in such a manner that the striker falls and normally hits the character "G" at the expiration of the standard time providing the actual time taken by the vehicle to cover the test path is greater than the said standard time, while it falls and hits the character "B" at the moment of the crossing of the end of the test path if the actual time taken is less than the standard time.

In the case where both a signalling apparatus and a registering apparatus are used, these will be combined to impress the conventional sign indicating the good result of the test in accordance with the normal automatic disappearance of the signal, and to impress the conventional sign indicating the bad result of the test in accordance with the disappearance of this signal and the appearance of the signal "bad" under the action of the contact at the end of the path. For this it will suffice in the embodiment of the preceding paragraph to arrange the signal "good" in the circuit of the operating magnet of the hammer, the signal "bad" being arranged in the circuit of the operating magnet of the reglet.

It is evident that for the sake of safety the check of the braking can be combined with the check of the grip of the tyres. To effect this check, according to a further feature of the invention, a second test path the surface of which affords a grip comparable to that of a road is provided on the sloping track, preferably below the first test path. This second path is preferably intended to be covered under the same conditions as the first path, and means are provided for comparing and indicating automatically the result of the comparison between the time taken to cover this second path and a second predetermined standard time.

In order to indicate the result automatically by means of a signal or registration or both, means exactly similar to those already described for indicating the result of the brake test can be used.

According to another feature of the invention the track of the path for testing the brakes and also, advantageously, that of the path for testing the grip of the tyres, are combined with means, such as side contacts in the case of an electro-mechanical installation, bordering this track on each side over its full length. These means are themselves combined with the mechanism effecting the appearance or emission of a rejection signal or with the means effecting the registering of a corresponding conventional sign in such a way that a skid proving bad braking or a bad tyre grip causes the production of this signal or of this registration notwithstanding the result of the test given by the value of the actual test time compared with the standard time.

In an advantageous embodiment which is combined with the aforesaid arrangements it is sufficient to arrange the side contacts of the track in parallel with the second contact of each of the test paths.

In order to be able to start the vehicle in the test in full safety, the present apparatus will advantageously be improved by the provision, above the first test path at the top of the slope, of a movable stop against which the vehicle will necessarily stop, the time of this stop being utilised to put on the brakes of the vehicle.

The stopping of the vehicle with its front wheels applied against this stop will be advantageously used to check the steering of the vehicle, the least play being observed under these conditions with great accuracy. The result of the check of the steering can be indicated by a simple signal or by means of a registration or by both these means, which can, moreover, be of the type already described.

Thus to indicate the result in the form of a registration one electro-magnet can be provided having a core attached to a reglet carrying two conventional characters, representing "good" and "bad", in front of a suitable support such as a paper band, card or the like, while a second electro-magnet is arranged to be energised through a contact operated by the tester and is adapted to displace a pluger arranged normally to strike the character indicating a good test result, the striking of the character indicating rejection being obtained after first connecting the first said electro-magnet in circuit through a contact which is also operated by the tester.

Further, in order to facilitate the bringing of the vehicle to rest at the desired point, the slope is advantageously proceded by an uphill slope.

Further, in an advantageous embodiment the said slope descends below the level of the ground and is followed by an ascent which enables a vehicle, the brakes of which have been found to be defective and which vehicle, as a result of this, has descended the slope at an excessive speed, to be slowed down to a normal speed.

In a further improved embodiment of the apparatus according to the invention, the part of the track comprising the descent and preferably, also the ascent following it, are covered by a tunnel so that these parts are protected from the

weather, thus ensuring that the tests are carried out under constant conditions.

In these circumstances it is advantageous for the lighting of these parts of the track to be effected by the lights of the actual vehicle being tested. In this case the installation is advantageously provided with means for effecting a test of the light beam emitted by the anti-dazzle headlights, of the vehicle.

In one embodiment these means can comprise a photo-electric cell which is combined with an indicating arrangement and is mounted at a height and at a distance from the starting point of the test of the lights, such that if the lights are correctly arranged the beam of light does not act on the cell. It will be noted that this photo-electric cell installation, owing to the existence of the tunnel, operates under better conditions than an installation in the open air.

The indicating and photo-electric cell arrangement can comprise, for example, a first signal the circuit of which is adapted to be closed by a time switch started by the vehicle passing a point selected for the start of the light test and is adapted to be opened by a relay operated by the photo-electric cell when the latter is acted upon by the light beam of the anti-dazzle headlights, and a second signal, constituting more particularly a rejection signal, the circuit of which is adapted to be closed by the same relay as well as by the said time switch in such a way that the appearance or emission of the second signal follows the disappearance or cessation of the first.

In another embodiment this indicating arrangement can comprise only the second said signal with the associated contacts.

The starting point for the test of the lights is advantageously combined with the starting point of one of the two test paths already described, in order to make use of the contact already provided at this point.

The indicating arrangement can comprise in addition, or alternatively, a registering device comprising an electro-magnet normally energised through the contact at the start of the light test and through a time switch. The movable core of the magnet is arranged to operate a striker which, on the opening of the circuit by the time switch applies a conventional character, such as "G" (good), indicating acceptance, onto a support arranged in front of it, which support may be a paper band, card or the like. This character and the character "B" (bad) are carried by a reglet attached to the core of an electro-magnet which is adapted to be energised when the photo-electric cell is acted upon by the light beam of the headlights so that its core then displaces the said reglet and brings the rejection character "B" into position to be printed in place of the character "G".

All the registering arrangements will preferably be grouped in a hut situated at the exit from the station. As for the signalling lamps they can be arranged on the edge of the track in sight of the driver, or they can be arranged in another hut in sight of a manager in charge of the station. They can also be duplicated, one series being arranged in sight of the driver and the other in sight of the manager as before.

The accompanying drawings show, by way of example, a constructional form of testing or checking apparatus for vehicles according to the invention.

In the drawings:

Figure 1 is a diagrammatic view showing the track and associated apparatus in longitudinal section;

Figures 2, 3 and 4 are transverse sections on the lines **2—2**, **3—3**, **4—4**, respectively of Figure 1,

Figures 5 and 6 are front sectional and side sectional views, taken to a larger scale, of the movable stop situated at the top of the inclined track;

Figure 7 is a detail view, to a scale larger than that of Figure 1, of the contact at the start of one of the test paths;

Figures 8 and 9 show in transverse section and in plan, the side contacts arranged at the edge of the test track;

Figure 10 is a diagram of a signalling device associated with one of the test paths;

Figure 11 is a diagram of another arrangement;

Figure 12 shows diagrammatically a registering device associated with one of the test paths;

Figure 13 is a diagram of another arrangement,

Figure 14 is a detail view of a magnetic clutch included in the device shown in Figure 13,

Figure 15 is a diagram of a combined signalling and registering device;

Figure 16 shows diagrammatically a registering device for giving the result of the test of the steering of the vehicle.

Figure 17 is a diagram of a signalling and registering device associated with the photo-electric cell for testing the headlights.

As will be seen from the drawings, the apparatus according to the invention comprises principally a sloping track **1** (see Figure 1), the part of which included between the points A and B constitutes the test path for checking the brakes. This part A—B, which affords a maximum tyre grip, is arranged to be traversed by the braked vehicle. In order to allow the tester to put on the brakes conveniently it is advantageous to stop the vehicle at the top of this path against a movable stop which is generally designated by **2** in Figure 1. With the same object, it is advantageous to provide an upward slope **3** in front of this stop to cause the vehicle to slow up before reaching the stop.

The tracks **1** and **3** can be arranged in any suitable manner, either by the adaptation of an already existing road or by means of a construction in stonework or in metal framing erected at the edge of a road.

The path A—B for testing the brakes is preferably followed, as already mentioned, by a path for testing the grip of the tyres, which path can be arranged immediately afterwards, for example from B to C. This second path, which can be less inclined than the previous one, is provided with a surface giving a grip to the tyres similar to that afforded by a road.

In addition to this second path, the track comprises an ascent **4** leading the vehicle back to the normal level N of the road. In order to ensure that the testing conditions remain constant, at least the part from A to C is protected by a tunnel constructed in any suitable manner. For example, the tunnel may consist of side walls and a metallic framework **5** (see Figures 1 to 4) supporting a roof **6**, the whole being such that the track is in relative darkness, this permitting the testing of the headlights to be effected as well.

In the sunk part of the track the framework **5** is arranged above walls **7** which border this

part up to the level N and the roof comes down on each side to this level. The movable stop **2** which may be of any suitable type is arranged, for example, as shown in Figures 5 and 6. It thus comprises a stop proper formed, for example, by a beam reinforced by U-irons **11** and provided in front with a rubber member **12** which is mounted across the track on arms **13**, each of which is pivoted on a transverse axis **14**. These arms which, under the action of their own weight, tend to drop with the beam into a gulley **15**, are each maintained in an operative position by a locking arm **16** on which a tail **13***a*, extending from each arm below its pivot, abuts.

The locking member is advantageously constituted by a roller **17**. Each arm **16** which carries one of these rollers, is pivoted about a horizontal axis **18** in such a manner as to be capable of pivoting in a plane perpendicular to the plane of movement of the arms **13**.

All the arms **16** extend below their pivots in the form of tails **16***a* and all the tails **16***a* are connected to each other by a coupling bar **19** which consequently extends transversely of the track in the lower part of the gulley **15**.

A transmission element such as a metallic cable in the form of a closed loop is attached to the two ends of the bar **19**. This cable passes round guide pulleys **21**, **22** and **23**, and at its upper part passes round a driving pulley **24** to whose shaft **25** is fixed a toothed wheel **26** driven at a reduced speed by a pinion **27** operated by a crank **28**. It will be understood that by operating the latter in one direction, the arms **16**—**16***a* will be pivoted to free the arms **13**—**13***a* from their locking members, thereby permitting the automatic withdrawal of the vehicle stop, whilst by reverse operation of the crank the said arms **16**—**16***a* are returned to their locking position shown in Figure 6.

It is however, necessary, previous to this second operation, to raise the arms **13**. To do this there is provided another operating element such as a cable **29** which need be attached to **30** to only one of the arms **13**, for example the centre one, these arms being connected one with the other by the stop member **10**—**11**. That part of the transmission element which is perpendicular to the support passes over the pulleys **31** and **32** is wound at its other end on a pulley **33** keyed to the shaft **25** which already carries the pulley **24**.

The arrangement is such that, when the crank **28** is operated in a direction causing the stop arms **16** to disengage, the transmission cable **29** is unwound and consequently allows the arms **13** to drop under the action of their weight, while during reverse operation of the crank the transmission cable **29** is wound up and causes the raising of the arms **13**, which is effected before the arms **16** are returned to the vertical position in which they lock the arms **13**. To ensure this it is sufficient to arrange, for example, a spring in the transmission cable **29** this spring being adapted to stretch during the last part of the operation, starting from the time when the arms **13** are erected.

There will now be described the part of the apparatus which, in combination with the sloping track A—B, enables the braking of the vehicle to be tested and indicates the good or bad results of this test according as to whether the braked vehicle covers, under the action of its own weight, the path A—B in a time greater or less than the predetermined standard time which may be denoted by *t*.

Several different constructions are possible. In one construction, the result is indicated merely by a visual signal. To this end, there are provided, at the starting point A of the path and at the end point B, two contact members or switches **40** and **41**, respectively (see Figure 1). Each contact member, which can be of any suitable type capable of being operated by the vehicle, may for example, be constructed as shown in detail in Figure 7. It then comprises a lever **45** pivoted at one end to a shaft **46** and having a boss **45**¹ which, under the action of a spring **47**, normally projects slightly above the floor of the track, the whole arrangement being located in a small channel **48** which is covered by a plate *s*.

The other end of the lever **46** is pivotally connected at **49** with a pawl **50** which engages in a ratchet wheel **51** which rotates solidly with a star wheel **52**. This star wheel has a number of fingers equal to half the number of teeth on the wheel **51**. A second pawl **53** holds the wheel **51** against back rotation.

The wheel **52** is insulated and is connected by means of a conductor **54** to one of the poles of a source of current, the other pole being connected by a conductor **55** to a contact **56** carried by a strip **57** in such a manner that the circuit is closed when one of the fingers of the wheel **52** engages the said contact **56**.

In the positions shown in Figure 7 the boss **45'** and the lever **45** are half depressed under the action of the advancing wheel of the vehicle, and contact is made. When the lever is completely lowered this contact will be broken. Thus contact is successively made and broken during one depression of the lever, that is to say during the movement of one tooth of the wheel **51**. A second depression of the lever **45** which is produced by the action of the back wheel of the vehicle will not, however, make any contact owing to the fact that the wheel **52** has only half the number of teeth of the wheel **51**, and it will only bring the following finger of the wheel **52** into a position ready to make contact. This contact will be made when a third lowering of the lever **45** is effected under the action of the advancing wheel of another vehicle.

Figure 10 shows diagrammatically one example of an indicating device making use of a signalling circuit including the contacts **40** and **41**. This device comprises a relay **60** adapted to be energised through the contact **40** and adapted to close an energising contact **61** of a time switch **62**. This closes a circuit over the path *p*—*q*, as a result of which a lamp **63** will be lighted for a predetermined period equal to the standard time *t* fixed for the covering of the path A—B.

The lamp **63** can be mounted, for example, on a post **65'** (Figure 1) situated at the edge of the track a little beyond the point B, in such a way as to be easily visible to the driver when the latter passes the said point B. This end point may be marked by any suitable means.

Obviously, the signalling lamp or lamps can be duplicated, both in the present case and in those which will be hereinafter described, one series being arranged in sight of the driver and the other series being arranged in a hut in sight of a manager in charge of the station.

If, the vehicle takes time greater than the standard time to cover the path A—B, the extinction of the lamp **63** taking place before the

passing of the point B by the vehicle will indicate that the braking is in order.

On the other hand, a relay 66 adapted to be energised through the contact 41 is adapted, when energised, to open a contact 67 and thus break the circuit of the lamp 63. If, then, the vehicle takes a shorter time than the standard time t to cover the path A—B, the lamp is extinguished at the moment the point B is passed and this indicates that the brakes are defective.

Figure 11 shows diagrammatically another form of device giving the result of the comparison between the time taken and the standard time in the form of a signal. In this device, as in the previous one, a relay 60 adapted to be energised through the contact 40 produces the lighting of a lamp 63 through the intermediary of the contact 61 and of a time switch 62. If the vehicle covers the path A—B in a time greater than the standard time the lamp 63 is extinguished before the passing of the point B and its extinction indicates that the braking of the vehicle is satisfactory.

But if, on the other hand the vehicle covers the path A—B in a time less than the standard time, the contact 41 situated at the point B energises a relay 68 which opens a contact 69 and closes a contact 70, causing the extinction of the lamp 63 and the lighting of another lamp 71 which is also mounted on the post 65′, but gives a light of a different colour. Thus the lighting of the lamp 71 at the moment of the passing of the point B is indicative of the defectiveness of the brakes.

It is also an object of the invention to provide means for effecting the comparison of the standard time with the actual time taken to cover the path A—B and for indicating the result of this comparison by means of a registering device provided instead of or in conjunction with a signalling device such as one of those just described.

Figure 12 shows a construction of one such registering device. This device comprises a cam wheel 72 provided with a tooth 73, which wheel is rotated by suitable means in such a manner as to make one revolution during the standard time, the starting of the rotation of this wheel being effected by the contact 40 and its stopping being effected by a time switch set in operation by the said contact.

In the path of the tooth 73 of the cam wheel 72 is a projection 74 mounted on a rod 75. The latter, which is guided in any convenient manner, is arranged to compress a spring 76 when being raised under the action of the tooth 73.

The spring 76 will produce a quick downward movement of the rod 75 as soon as the tooth 73 has passed the projection 74.

The rod 75 is provided with a head 77, opposite the end of which is a long resilient reglet 78 carrying two conventional characters 79 and 80 such as "G" and "B", adapted to indicate the good or bad result of the test. These characters are arranged so as to act on a suitable fixed or movable support 81, such as a card or a paper band, to make an impression thereon either by perforation or by printing, an inking device naturally being provided in the latter case. At the time of striking the reglet 78 flexes under the action of the momentum of the striker 75—77, operated by the spring 76, and makes the impression. It returns resiliently and slightly lifts the rod 76—77, thus relieving the support 81.

The parts are so arranged that normally the character 79 ("G") of the reglet is opposite the rod 75—77 so that this character can be printed at the expiration of the standard time, the wheel 72 naturally beginning its rotation at the moment when the vehicle passes the starting point A of the test path. If, on the other hand, the vehicle covers this path in a time less than the standard time the device then imprints the character 80 ("B") in place of the character 79 ("G").

This can be brought about by, for example, attaching the reglet to the plunger core 82 of a solenoid 83 or to the armature of an ordinary electro-magnet, the energising circuit of which is adapted to be closed by the contact at the end of the test path, which would be the contact 41 for the testing of the brakes. A spring catch 84 is provided in order to retain the core 82 so long as the time switch, which was set in operation by the contact 41, is still closed.

It will be seen, therefore, that if the solenoid 83 is energized before the end of the standard time it will move the character 80 ("B") opposite the rod 75—77 so that this character will be printed on the support 81 at the moment of the dropping of the rod.

An electro-magnet 85 energised through the contact 40 at the beginning of each test and adapted to attract the catch 84 will ensure the return of the core 82 and of the reglet 78 to their initial positions.

In another embodiment shown in Figures 13 and 14, the cam 72—73 is fixed to a plate 86 of magnetic metal which is included in the magnetic circuit of an electro-magnet 87 contained in the body of it, which circuit embraces a disc 88. This disc is permanently rotated at a uniform rate so that, on energising this electro-magnet by means of a time switch set in operation by the contact 40, the plate 86 is magnetically attracted to the disc 88 and in consequence the cam is rotated for a time equal to the standard time. The parts are so arranged that, during the course of this movement, the cam 72—73 leaving an abutment 89 raises the projection 74′ of the rod 75 and lets the latter fall again at the end of the standard time. At this moment the cam wheel 72 is freed from the attraction of the disc 88 and returns to its original position under the action of a spring 90 which was stressed by the previous rotation of the cam wheel.

In this construction the projection 74′ of the rod 75 is pivoted to the latter by means of a pin 91 in such a manner that the tooth 73 of the cam 72 can pass it during the return movement of the latter, whilst an abutment 92 locates this projection during the course of the raising of the rod.

If the vehicle covers the path A—B in a time less than the standard time t, the electro-magnet 83 is energised as in the preceding arrangement and ensures in the same way the impression of the character 80 ("B") in place of the character 79 ("G").

In this new construction, as in the preceding one, an electro-magnet 85, energised at the beginning of the test through the contact 40, ensures the disengagement of the catch 84 and consequently the return of the core 82 and of the reglet 78 to their initial positions, assuming that they have been previously displaced for the impression of the sign 80 ("B").

As has been said, the apparatus can comprise at the same time signalling means and registering means for comparing the standard time with the actual time taken by the vehicle to cover the

test path and for indicating the result of the comparison, it being possible to combine these two means.

Figure 15 shows diagrammatically and by way of example an arrangement for doing this, comprising the combination of signalling means and registering means of the previously described kinds. In this construction a relay 60, energised through the starting contact 40, closes a contact 61 which starts a time switch 62 ensuring, for a time equal to the standard time, the lighting of a lamp 63 and the energisation of an electro-magnet or of a solenoid 95 which raises, and retains raised against the action of a spring, a striker 96, opposite which is normally arranged the character 79 ("G") carried by the reglet 78. This reglet is similar to those of the arrangements of Figures 12 and 13 and also carries the character 80 ("B").

If the time taken by the vehicle to cover the path A—B is greater than the standard time t, the lamp 63 is extinguished at the expiration of the standard time before the passing of the point B, and, simultaneously, the striker 96 falls rapidly effecting the impression of the character 79 ("G") on the support 81 which may be a paper band.

If the time taken by the vehicles to cover the path A—B is less than the standard time, a relay 97 energised through the contact 41 at the end of the passage closes, initially through the contact 98, the circuit of an electro-magnet or of a solenoid 83, similar to those of the preceding figures, which displaces the reglet 78 and brings the character 80 ("B") opposite the striker 96. It then opens the contact 99 producing also the extinction of the lamp 63 and the falling of the striker 96 which imprints the character "B" on the support 81. The illumination of a lamp 71 gives the signal "bad."

For testing the grip of the tires, which is effected when covering the path from B to C (Figure 1), it being understood that it is again the question of a comparison between the actual time taken to cover this path and a new standard time t', similar means can be used to effect this comparison and to indicate the result. In this case and supposing the two paths are disposed immediately following one another as in Figure 1, the functions which would be effected for the testing of the brakes by the contact 40 in combination with the devices of Figures 10 to 15, will for the testing of the grip of the tires, be fulfilled by the contact 41 in combination with devices similar to those previously described, whilst the aforesaid functions of the contact 41 will be performed, in the new arrangement, by a new contact 42 arranged at the point C, the time switch employed in the new arrangement naturally being arranged to open the circuit at the expiration of the time t'.

Thus, in the case of an arrangement enabling the grip of the tyres to be tested comprising a signalling device of the type of Figure 10, the circuit of the relay 60 of this device will be closed by the contact 41, and that of the relay 66 will be closed by the contact 42. And if the installation comprises at the same time a device like that of Figure 10 for the testing of the brakes and another similar device for the testing of the grip of the tyres, then the contact 40 will close the circuit of the relay 60 of the brake testing device, the contact 41 will close simultaneously the circuit of the relay 66 of the brake testing device and of the relay 60 of the tyre grip testing device, and the contact 42 will close the relay 66 of the tyre grip testing device. The signalling lamp or lamps can be mounted on a post 65^2 (Figure 1).

Similarly two registering devices, the first for the testing of the brakes and the second for the testing of the tyre grip, can be used, these devices being similar to those already described.

In the case where these registering devices include the use of the magnetic coupling of Figure 14, the cam 72' of the device registering the result of the test of the tyre grip and its plate 86' will be arranged on the opposite side of the disc 81 so that when the contact 41 is operated by the vehicle this plate 86' will couple with the disc 88 for a time equal to the second standard time t'.

As has been said, for the testing of the brakes and, also, advantageously for the testing of the tyre grip, the present apparatus will advantageously comprise, besides the means already mentioned, means adapted to be operated by a resulting skidding of the vehicle in the path A—B and also in the path B—C to give, on this occurring, the indication of a bad result by signalling or by registering or by both.

To this end the track 1 is bordered on each side from A to B by a contactor 43 and from B to C by a contactor 44, these contactors being adapted to function under the effect of a blow. These contactors, which can be of any suitable type, may, for example, be constructed as shown in Figures 8 and 9.

Each of them then comprises a rigid member 100 extending the length of the track and constituted, for example, by an iron U member which is adapted to slide horizontally, in a direction perpendicular to the length of the said track, within a housing 101 formed in the vertical face 102 of the edge of the track 103. The member 100 is pivoted by means of pins 104 to cranks 105 which for their part can be oscillated about fixed axes 106 fitted in the track. Springs are provided at intervals in order to ensure a rest position for this assembly in which the member 100 partially projects from the side 102 of the track.

One of the cranks 105 carries a contact part 107 connected to a conductor 108, while in the curved path of the contact 107 is another contact part 109 connected to another conductor 110. This contact is carried by an arm 111 pivoted at 112, and the device is lodged in an enlargement of the housing 101. The arm 111 is preferably resiliently maintained in its rest position, for example by means of a spiral spring 113, so as to ensure the resiliency of the contact.

It will be understood that in order to obtain, by means of the contacts 43, the appearance of the signal "bad" or the registration of the corresponding sign, it is sufficient to connect these contacts in parallel with the contact at the end of the brake test track which is already arranged to give this signal or to register this sign in combination with the device for testing the brakes.

Thus, for example, in the case where a device such as that of Figure 11 is employed for the testing of the brakes the contacts of the two contactors 43 will be connected in series with those of the contact 41 of the relay circuit 68. On the other hand in the case where a device such as that of Figure 15 or that of Figure 12 is used, the said contacts can be connected in parallel with the contact 41 in the relay circuit 97 (Figure 15) or in the electro-magnet circuit 83 (Figure 12). As there is no reason why skidding should occur at the end of the path and it could, consequently, ensue unexpectedly after the expiration of the

standard time, this occurrence will always usefully operate with these devices to cause the signal "bad" to appear and the sign "B" to be registered.

The adaptation of the contactors 44 to give the desired result will be effected in the same fashion, that is to say by connecting these contactors in parallel with the contact 42 at the end of the tyre grip test track, which already produces, in combination with the device adopted for this test, the appearance of the bad signal or the registration of the corresponding sign.

As has been previously stated, before traversing the two tracks for testing the brakes and the grip of the tyres the vehicle is brought to rest with its wheels pressing against the movable stop 2. This opportunity is advantageously utilised in order to examine the steering of the vehicle, the least play in the steering being, in these conditions, detected perfectly with operation of the wheel.

This operation being effected by the service tester in the presence of the driver of the vehicle, it is useless to provide a signalling device, unless it is desired to transmit the result to a distance, for example to another tester in a hut at the exit of the station, in which case it would simply be necessary to provide two lamps, one or the other being illuminated according to the good or bad result by means of a corresponding hand switch.

On the other hand it is advantageous in all cases to register this result.

To do this a device analogous to those already described can be used, save that it will not comprise a time switch and the contacts will be operated by the hand.

Figure 16 shows such a device. An electromagnet or solenoid 120, the core 121 of which is integral with a flexible reglet 122, carries two characters 123 ("G") and 124 ("B") in order to indicate a good or bad result. The circuit of the magnet can be closed by means of a hand contact 125.

At rest, that is to say when the circuit is open, the character "G" is in front of a striker 126 which is suitably guided and is integral with the core 127 of a second electro-magnet or solenoid 128. This core is raised when the circuit is closed by means of a hand contact 129, to fall again immediately this contact is released. This applies the character "G" to a support 131 such as a card or a paper band.

After its bending due to the impact of the striker, the reglet 122 restores itself to its initial position and frees the support 131. If the result of the test is bad it is sufficient to operate, prior to the striking, the contact 125 Then it is the character 124 ("B") which is presented under the striker 126 in order to be imprinted. it being maintained in position either by a prolonged closure of the contact 125 or by an automatic catch which will be eventually disengaged, for example by means of a third electro-magnet 133 energised through a third contact 134.

As has been said the test tracks transversed by the vehicle are covered by a tunnel which, by protecting the various parts of the track from the weather, maintains their coefficients of friction at a substantially constant value and consequently permits, other things being equal, of like results being obtained at all times without it being necessary to modify the adjustment of the apparatus in respect of the standard times t and t'.

This tunnel is also arranged, according to a further feature of the invention, in such a manner as to produce relatively complete darkness, giving thus conditions suitable for the test of the light beam emitted by the anti-dazzle headlights of the vehicle. It would be difficult to effect this test by day in the open air.

To effect this test according to the invention the apparatus already described would advantageously further comprise a photo-electric cell in combination with a signalling device, a registering device or both.

Adopting, for example. the point B as the start of the test track for the lights, the photo-electric cell which is generally designated by 140 in Figure 1 is arranged at a distance from this point and at a height above the level of the track such that the cell cannot be influenced by the light beam emitted by the lights if the top of the beam is at such a regulation height that the beam is non-dazzling.

The device for indicating the result of the test, which will be used in combination with the photoelectric cell. can consist of signalling or of registering means or both.

In order to give the indication in the form of a signal use can be made of a lamp 141 (Figure 17), arranged so as to light up at the moment of the passing of the starting point of the light test, which may be the point B in the example chosen, and to remain lighted during a certain time. This lamp indicates when the light beam is correct, while another lamp 142, giving a light of a different colour and which lights only if the cell is influenced by the said beam, and this after the extinction of the first, is provided to indicate when the beam is incorrect.

To this end the circuit of the lamp 141 can be closed by a contact 143 (Figure 17) controlled by a relay 144 energised through the contact 41 at the point B and a time switch 145. The circuit of the lamp 142 comprises a contact 146 adapted to be closed by a relay 147 which operates when the cell 140 is acted upon by the light beam, this relay ensuring first of all the extinction of the lamp 141 through the opening of a contact 148. This arrangement could be limited, as will be understood, to the single lamp 142 arranged in such a manner as only to give the signal of rejection when there is cause.

The above arrangement can comprise a registering device, for example of the kind already described, which is advantageously arranged as shown in Figure 17.

In this example a solenoid 149 is arranged to be energised at the same time as the lamp 141 and to raise then the striker core 150 below which is normally presented a character 151 "G" ("Good") in such a manner that this character is imprinted on the support 152, which may be a card or paper band, upon the dropping of this striker, which will be produced at the moment of the opening of the circuit by the time switch 145. But if the photo-electric cell 140 is acted upon by the light beam another solenoid 153 adapted to be energised at the same time as the lamp 142, displaces the flexible reglet 154 which, in addition to the character 151 ("G"), carries a character 155 ("B"="bad"), and thus brings the character "B" under the striker 150, so that this character is impressed in place of the character "G".

It will be understood that if the cell 140 is influenced by the light beam this lasts the full time of the test and, consequently, the contact 146 is closed during all this time. Thus it follows that the character "B" is maintained in position under the striker till the moment of the

impression. It is, therefore, useless to provide a locking device as in the case of Figures 12 and 13.

On the other hand as the influencing of the cell by the light beam, if it takes place at all, begins at the beginning of the test, it follows that the duration t^2 of the closing of the circuit, which is effected by the contactor **145**, can be very short.

It will be easily understood from the description which has been given that all the test operations effected with the present apparatus are very rapid and will not, consequently, give any difficulty to the user who wishes to test his vehicle, for example at the beginning of a long journey.

It will be understood also, that it is possible to centralise all the registering devices in, for example, a hut such as **160** (Figure 1) at the exit of the station, where the registrations would be delivered to the driver of the vehicle. The electric cables leading to this hut could be enclosed in a channel **161** (Figure 3).

Naturally the invention is not limited to the constructions described and illustrated, since it comprises any modifications, in the number of which it is necessary to include, as already mentioned, those in which the signalling devices are of the audible type. In this case, for the sake of simplification, these devices would preferably only emit an audible signal when the test result is bad, which signal would take the place of the lamp **71** in the embodiment of Figure 15, or of the lamp **142** in that of Figure 17, the other lamp **63** or **141** of these arrangements being omitted.

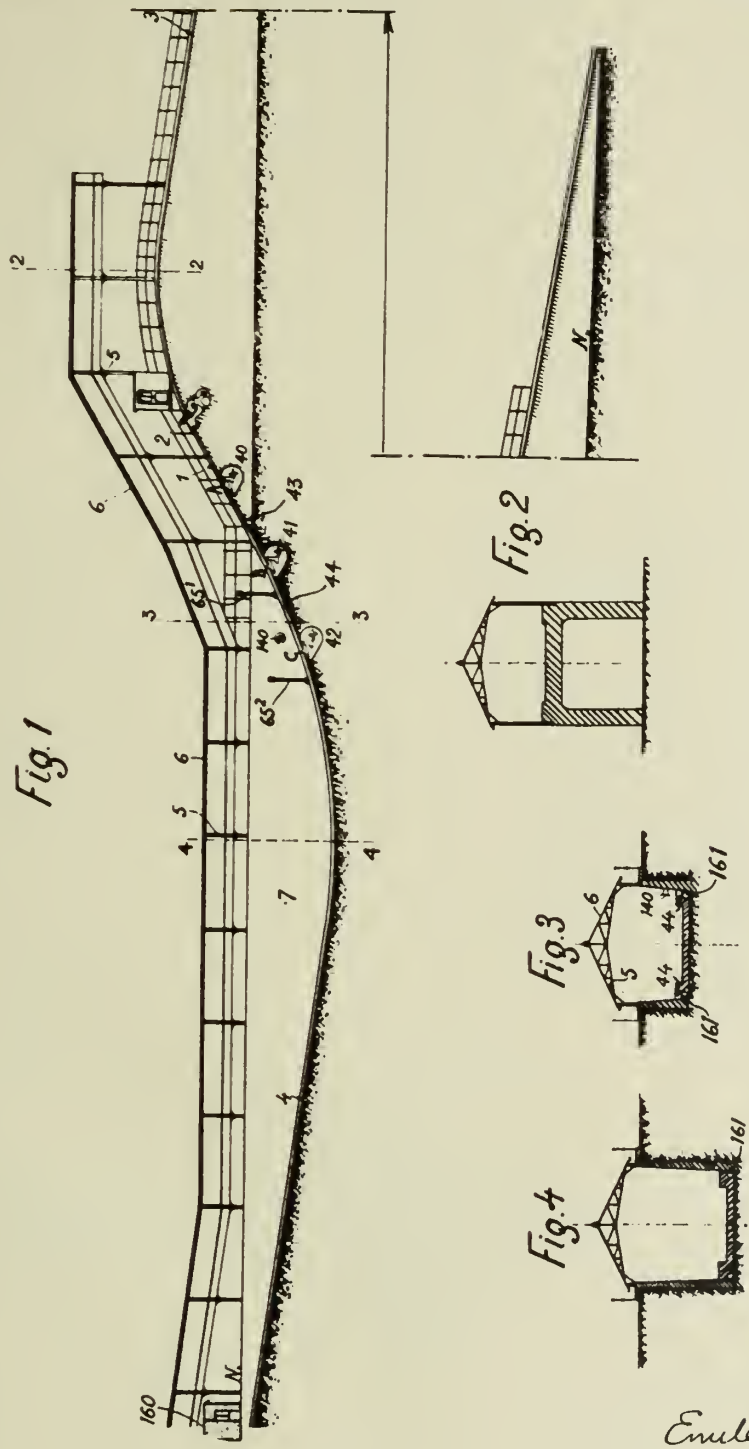
Finally the invention also includes all other forms of devices indicating the result of the test of the brakes and of the grip of the tyres by signalling, registration or both which include purely mechanical means operated by the passage of the vehicle past the starting and end points of each path or by a blow resulting from a skid, in combination with clockwise apparatus, the signals being given then by movable or rotatable discs.

EMILE PIQUEREZ.

PUBLISHED
JUNE 15, 1943.
BY A. P. C.

E. PIQUEREZ
APPARATUS FOR TESTING VEHICLES
Filed Jan. 14, 1939

Serial No.
251,010
5 Sheets-Sheet 1



Inventor
Emile Piquerez
By Sommers & Young
Attys

PUBLISHED
JUNE 15, 1943.
BY A. P. C.

E. PIQUEREZ
APPARATUS FOR TESTING VEHICLES
Filed Jan. 14, 1939

Serial No.
251,010
5 Sheets-Sheet 2

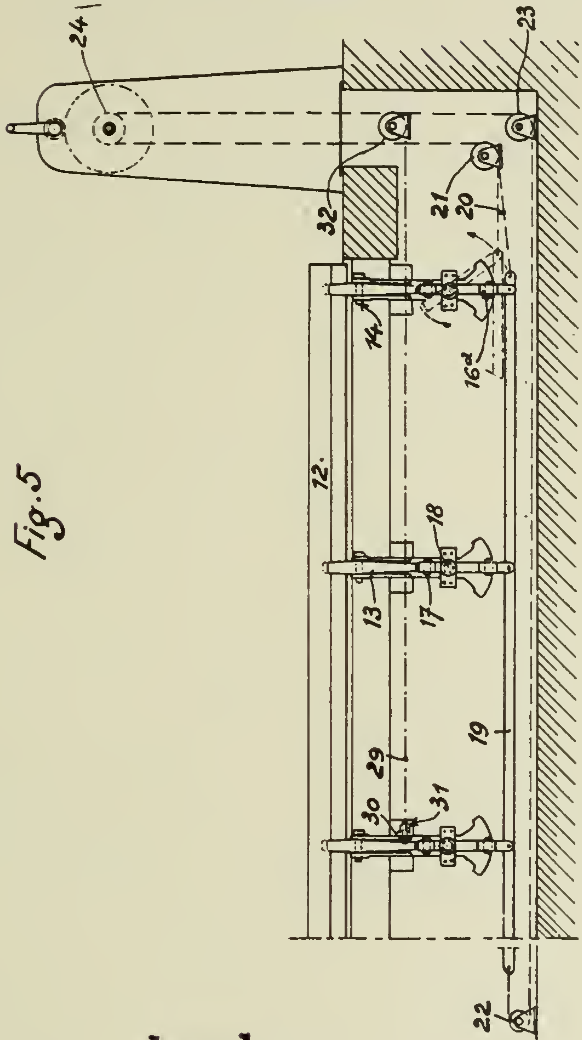


Fig. 5

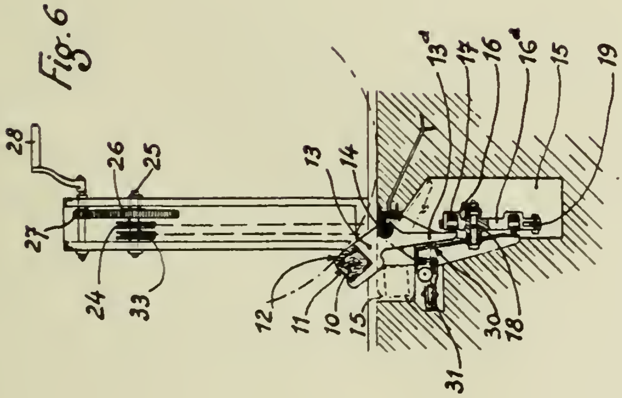


Fig. 6

Inventor
Emile Piquerez
By Sommers & Young Attys

PUBLISHED

JUNE 15, 1943.

BY A. P. C.

E. PIQUEREZ

APPARATUS FOR TESTING VEHICLES

Filed Jan. 14, 1939

Serial No.

251,010

5 Sheets-Sheet 3

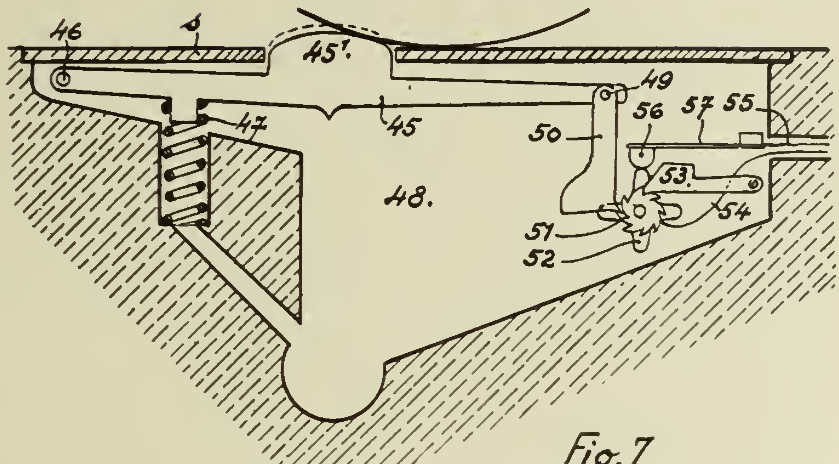


Fig. 7

Fig. 8

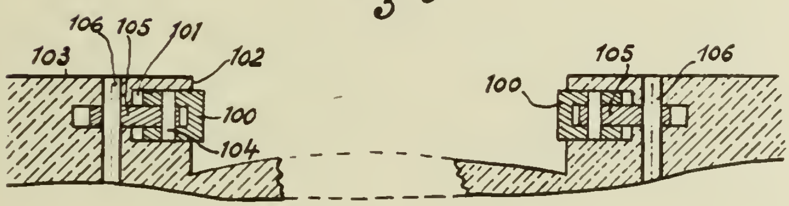
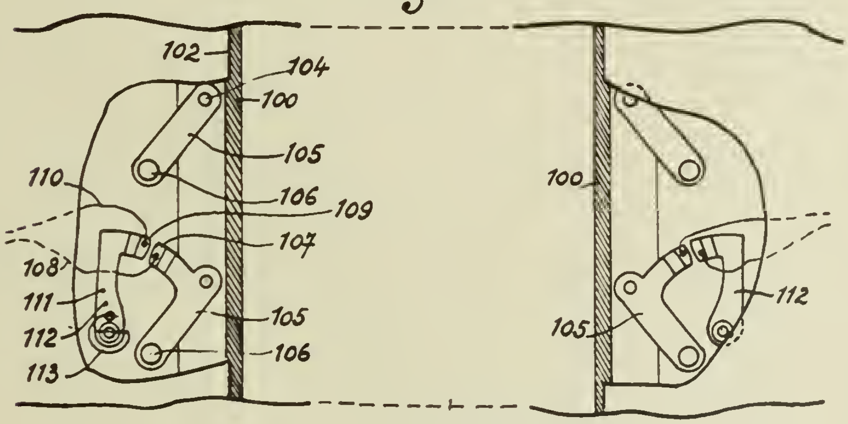


Fig. 9



Inventor
Emile Piquerez
By Sommers & Young Attys

PUBLISHED
JUNE 15, 1943.
BY A. P. C.

E. PIQUEREZ
APPARATUS FOR TESTING VEHICLES
Filed Jan. 14, 1939

Serial No.
251,010
5 Sheets-Sheet 4

Fig 10

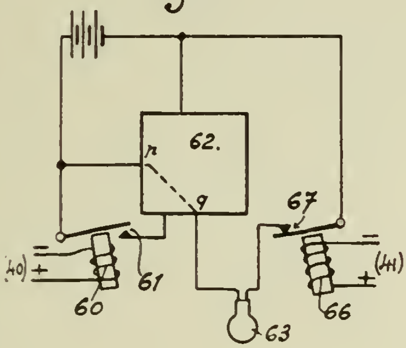


Fig. 11

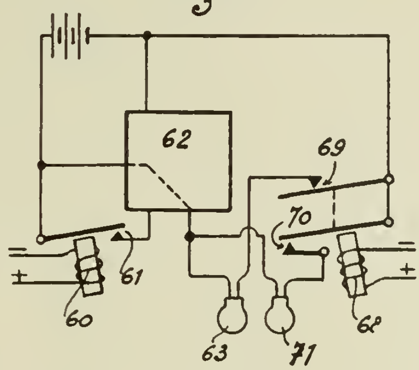


Fig. 15

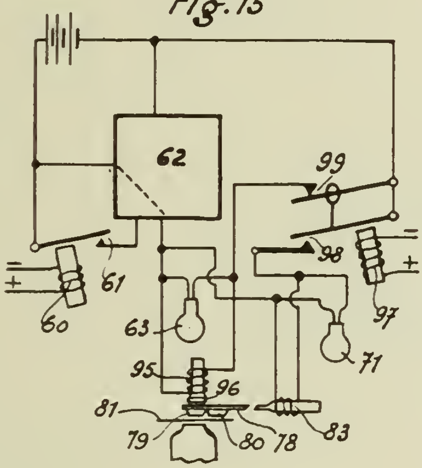


Fig. 17

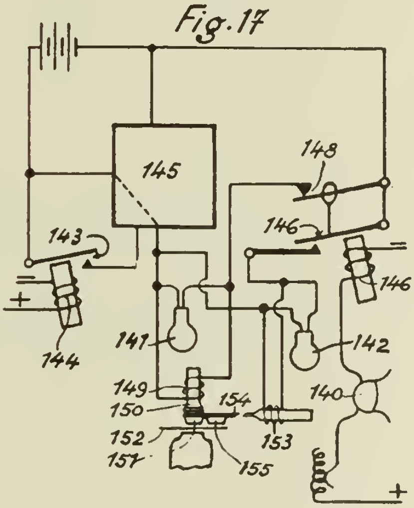
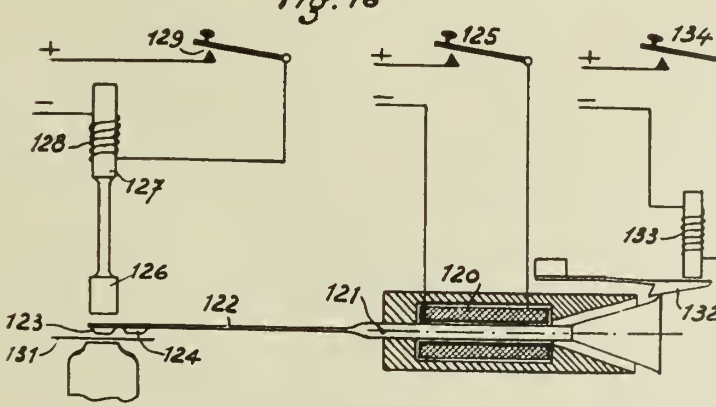


Fig. 16



Inventor
Emile Piquerez
By Sommers & Young Attys

PUBLISHED
JUNE 15, 1943.
BY A. P. C.

E. PIQUEREZ
APPARATUS FOR TESTING VEHICLES
Filed Jan. 14, 1939

Serial No.
251,010
5 Sheets-Sheet 5

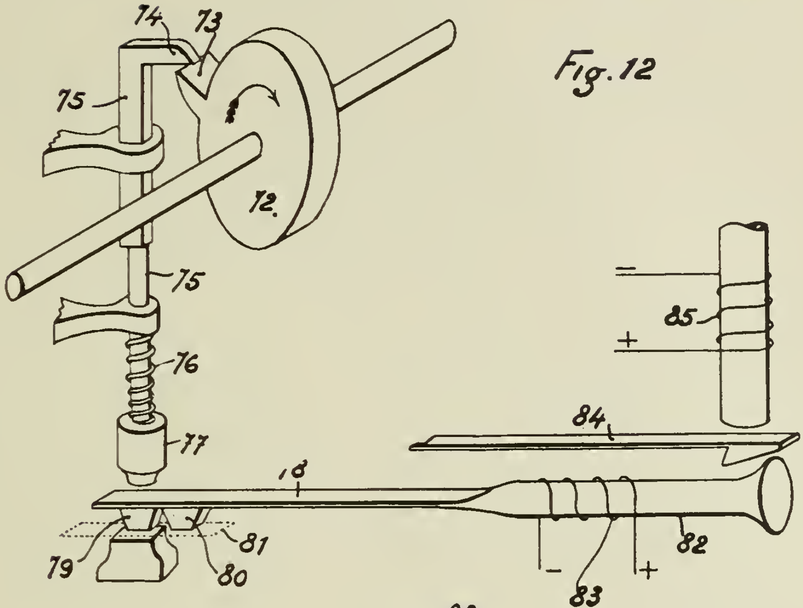


Fig. 12

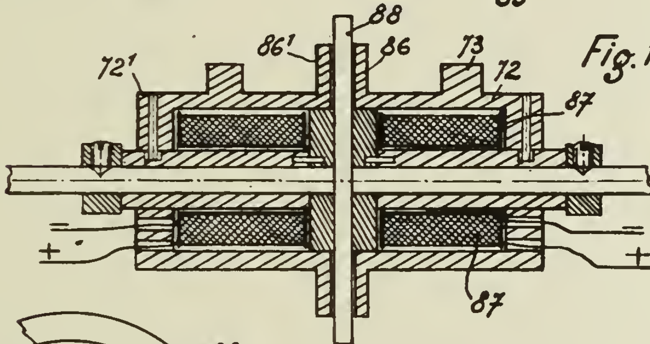


Fig. 14

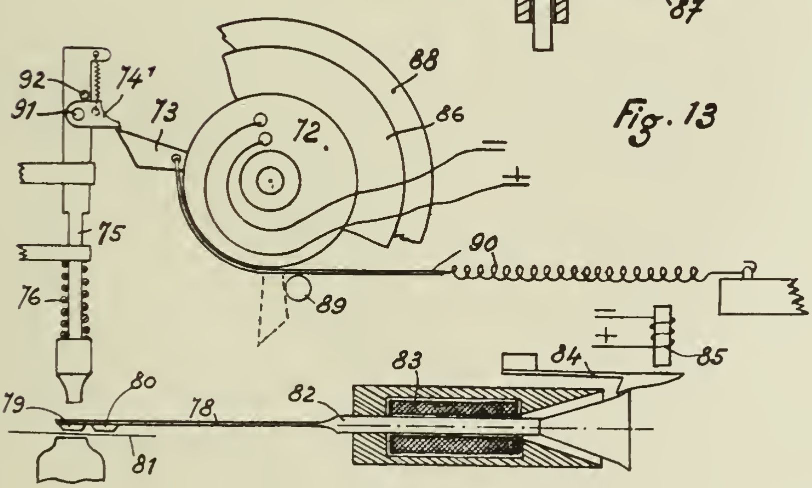


Fig. 13

Inventor
Emile Piquerez
By Sommers & Young Attys

Published June 15, 1943

Serial No. 254,730

ALIEN PROPERTY CUSTODIAN

PROCESS FOR THE MANUFACTURE AND PRODUCTION OF DETERGING, EMULSIFYING, WETTING AND DISPERSING AGENTS

Shosaburo Akahori, Tokyo, Japan; vested in the Alien Property Custodian

No Drawing. Application filed February 4, 1939

This invention relates to a process for manufacture and production of deterging, emulsifying, wetting and dispersing agents which has peculiarity in acting sulphonating reagents such as concentrated sulphuric acid, fuming sulphuric acid, chlorsulphonic acid on fatty material which obtained by saponification of wool fat with acting agents, such as caustic alkali, acids, or by hydrolysis under pressure, or on those products which obtained by substitution of ester radicals of the said fatty material with alcohols. The object of this invention is to make a product by extracting the whole matters of wool fat as sulphuric compound without using any special organic solvents and to obtain the product which has remarkable acting power in deterging, wetting, emulsifying and dispersing against acidic solution, alkaline solution, hard water, and seawater.

It is already known to produce higher fatty alcohol sulphonate by acting sulphonating reagent on general waxes using special organic solvent, also there are some literature on the sulphonation of wool fat. However, it has not been clear about the component of wool fat and it has been considered that the wool fat has the same component as the other waxes, but, if you apply the former method on wool fat, the component of wool fat which has the carboxyl group be removed by solving into the solvent and be avoided uselessly not coming into the product, on the other hand, if you apply the latter method acting only sulphonating reagent, the acidic saponification of wax ester is very difficult and some of the component remain as wax ester in the product and it spoils the quality of the product.

However, I, the inventor of this subject, after having made many experiments on the components of wool fat, have discovered that wool fat has a chemical property that is remarkably different from other general waxes. The proper components are special quality oxy-acids, and cholesterin, iso-cholesterin, that do not contain long chain radicals. The oxy-acids are not only contained abundantly in wool fat but the sulphuric acid ester or sulphonic acid or salts are quite different from the sulphuric acid ester or sulphonic acid that were already known, and it has eminent effect as deterging, wetting, emulsifying and dispersing agents. Besides, it was discovered that you can sulphonate the sterol in these component easily by substituting the ester radical with methyl alcohol, ethyl alcohol, or saponifying it with alkali, acids, or by making it fatty material, by demand mixing mineral acid or hydrolysis under pressure. Thus the invention was accomplished on the ground of those discovery and the details are as follows.

When you substitute ester radical of crude or refined wool fat with methyl alcohol, ethyl alcohol, alcohol combines with carboxyl group of wool fat at the same time hydroxy group that has been combined with carboxyl group become free. On that condition if you act sulphonating reagents such as concentrated sulphuric acid or chlorsulphonic acid, the sulphate radical combine with hydroxy group in the wool fat to produce sulphonate ester or sulphonic acid. Also, after saponified the said wool fat with caustic alkali or acids under certain pressure, or by elevating pressure, mix mineral acid like sulphuric acid, or making it fatty material by hydrolysis under pressure, then if you act directly the sulphonating reagent such as concentrated sulphyric acid, fuming acid, chlorsulphonic acid, the proper component of wool fat almost combine with sulphonating reagent and be obtained as perfectly sulphuric compound.

Also, the inventor has discovered that the many components that obtained from wool fat by the abovementioned methods, have different action for sulphonating reagent, so that for the object of use of the said each product you can make it excellent product which suits each use by mixing it more differently than natural quantity. Consequently when you put this invention in practice you can obtain the most appropriately harmonized product by acting sulphonating reagent on the component of the said fatty material after changing the rate of each component, or after sulphonating the component separately mix it as demanded combining rate. Now, the experiments in each case are as follows:

1. To the 100 kg. of wool fat of which saponification value 115.0, acid value 10.5, adding 40% caustic soda 50 kg. and saponify it stirring for about 10 hours under 95° C. Then heat it stirring and adding abt. 200l of water and make the anticipated fatty material separate combining sulphuric acid. The saponification value of this material is 113.0, acid value is 96.0 and the decomposition rate is 85.7%. In the fatty material obtained thus, drop 15 kg. of sulphuric acid stirring, then, after sulphonating it by dropping fuming sulphuric acid 5 kg. add water 100l and stir it and make it standing and remove the acidic waste that come separate in the lower layer and use the higher layer, i. e. sulphuric compound

as it were, or after dried it neutralizing with alkali.

2. In the abovementioned wool fat 100 kg. pour 40% caustic soda 50 kg. and putting it in a closed apparatus, then saponify for 6–7 hours under 120°–130° C., pressure 50 lbs. per square inch, then make it fatty material by adding mineral acid. The saponification value of this material is 120.0, acid value 109.7, decomposition rate 98.0%, then make it sulphuric compound by acting sulphonating reagent, and use it as it is or after dried it neutralizing with alkali.

3. With the abovementioned wool fat 3 kg. combine ethyl alcohol 3 kg., caustic soda 0.05 kg., and substitute the ester radical by heating and stirring, then distil excessive alcohol and remove it, then neutralize caustic soda and saponified alkali with sulphuric acid, in this product, fatty material, drop stirring concentrated sulphuric acid, then after washing neutralize with caustic soda and dry it. But, to combine alkali when we substitute ester radical is to make the said reaction more effective using it as catalyzer, and we get almost the same result with organic solvent like petroleum benzine.

4. First stir wool fat 100% and 40% caustic soda 50% for about 10 hours under 95° C., then get fatty material by combining sulphuric acid heating together with water 100%. Then treat this product with petroleum ether and extract soluble part from it and sulphonate dropping concentrated sulphuric acid. Use this product as it is or after drying it neutralizing with alkali. This product is good for absorbing agent.

5. Adding 5% concentrated sulphuric acid finely to wool fat 100% heating 90°–120° C. and stir for about 3 hours, then divide it soluble part and insoluble part using alcohol, and sulphonate them separately and get each homogenous sulphonating reagent. We get the product from this sulphonating reagent as it is, or combining in several rate, e. g. the product which contain much soluble part is effective as deterging agent.

6. To wool fat 100% add zinc oxide, calcium oxide 3% or without adding them, act hydrolysis by steaming in an autoclave. Then, divide the fatty material which was got thus, in distillable part and not distillable part by vacuum distillation and after sulphonate each part separately use the product as it is or combining in any rate.

The product which obtained by this invention is far superior in the operation of deterging, emulsifying, wetting and dispersing than the many products which sulphonated using this as raw materials or using lanolin acid or higher alcohol under the wrong knowledge of past.

That is (A) the product which obtained by separating acid part from wool fat and sulphonate, then neutralize it, with caustic soda, (B) the product which obtained by separating not saponifiable part from wool fat and sulphonate it, then neutralize with caustic soda, (C) the product neutralized with caustic soda after sulphonating the whole components of wool fat by the process mentioning (instance of experiment 1). Then, making these three samples phenol phthalene neutrality and determined with dyne centimeter the surface tension which is fundamental property to compare the superiority or inferiority of the action of deterging, wetting, dispersing, emulsifying, and etc. under the same condition, we got the results as mentioned below, but the method of testing them is made by taking 0.1% solution from each sample and acted by dropping number calculation under 30° C., 40° C. and 50° C.

Sample	30° C	40° C	50° C
(A)	52.56	53.57	53.99
(B)	64.11	63.51	59.61
(C)	46.42	43.88	41.52

As you see in the above table the surface tension of the product (C) made by the process mentioning is weaker about 28%–31% comparing to (B) and about 12%–23% comparing to (A). Next, in testing quality of each sample (A) is good in solubility but less colloidal, (B) is bad in solubility and more colloidal, (C) is good in solubility and more colloidal, too.

After all, this invention is to extract the whole main components of wool fat without any loss as a sulphonating product, the product which obtained by substituting ester radical is colloidal and superior in wetting action.

Now, the product which obtained by this invention can be not only made as a perfect product which is proper in the every use as the fibre industrial agent like leather industry, textile industry, etc., but also it can not be acted by hard water or dissolve easily in sea water and shows the many actions as mentioned before. Also, if you combine this in the dental powder (or paste) it makes the quality superior and it is very effective to make the detergent action of mouth perfect, by double decomposition with base as calcium carbonate, magnesium carbonate which were contained in the usual, soap without the fear of producing insoluble salts like calcium soap, magnesium soap.

SHOSABURO AKAHORI.

Published June 15, 1943 Serial No. 254,744

ALIEN PROPERTY CUSTODIAN

PROTECTIVE MATERIAL AGAINST WAR GASES AND CHEMICALS AND METHODS OF MAKING THE SAME

Gerhard van der Veen, The Hague, Holland; vested in the Alien Property Custodian

No Drawing. Application filed February 4, 1939

It is known that glycerol affords protection against the action of war gases or chemicals. It has not, however, been possible to apply glycerol to a fabric to obtain a durable protective material. It is also known that cellulose acetate has a protecting action with respect to the said chemical fighting means. All attempts, however, to apply this material to fabrics have not succeeded, because this material cannot be pasted or quilted on to the fabric. Moreover, the drawback of cellulose acetate is that it becomes brittle, if it is dried after having been wet.

Now, it has been found that materials consisting of a core comprising one or more layers of fabric in and/or on and/or between which are applied one or more natural gums and/or permanently water soluble, artificial resins, not capable of being hardened, dissolved or plastified by means of a solution of a bi or more valent alcohol, or of a substitution product of it, or of a mixture of such materials mixable with water and which inner layer is provided at both sides with a waterproof outer layer, are absolutely impervious to all chemical fighting means. The materials dissolved or plastified by means of the said solution, form the medium resistant to the gases. As this medium is water soluble, it must be shut off from the atmosphere by outer layers of waterproof material, because otherwise the material should soon become sticky under influence of moist air.

In order to make the outer layers adhere firmly and durably to the active inner core, it is necessary that between both there is a layer of adsorbing material. These intermediate layers stick as well to the inner core, which is a little sticky, as to the outer layers, so that a united material is obtained.

The solutions or masses to be used can be preserved if desired, as for instance with boric acid, benzoic acid, salicylic acid or such preservatives. For the rest some multivalent alcohols possess also a preserving action. Many alcohols and alcohol mixtures may thus be used. It has been found that satisfactory gas-tight and cheap material can be obtained when gum arabic or tragacant is used in an aqueous solution of glycol and glycerol. Also, with good results, permanently water soluble artificial resins not capable of being hardened can also be used, for which the different kinds known per se can be used.

As waterproof outer layers good results are obtained with layers of rubber, which, for instance, can be applied to the tissue in the form of latex and which afterwards can be vulcanised. It has also been found that the latex can be vulcanised also by treatment with an alcoholic solution of shellac.

The waterproof layer, however, can also be prepared from artificial resins capable of being hardened, which are hardened, when the resin layer has been applied, after which they are waterproofed.

The intermediate layers of adsorbing material which are to be applied between the inner core and the outer layers, may consist of fabric, paper, fibres, wood or cork powder and such material which, as has been described above, sticks firmly to both layers to be connected and forms thus a good connecting medium.

It has furthermore been found that tissues extraordinarily impervious to war gas and extremely flexible can be obtained and that also, if desired, the intermediate layers can be spared, if care is taken, that the quantity of bi and/or more valent alcohols with respect to the quantity of gums and/or artificial resins used is chosen in such a way that, after drying, the mass applied in, on and/or between the layer or layers of fabric comprising the core is present in the form of dry, non-sticky flexible layers.

The optimum proportion for the gums or artificial resins and the said alcohols or their substitutes which is different for the several materials, can be fixed simply for each case by experiments.

It appears that the obtained dry, flexible layers consist of a homogeneous material, possessing extraordinary properties for resisting war gas.

It is not surely known what is taking place when mixing the two said groups of materials in the above-mentioned proportions. It is meant, however, that the alcohols combine with the acids present in the gummy or resinous materials, or that they go in these materials in solid solution.

The last-mentioned homogeneous material is water soluble and is able in this form to apply gas-tight layers to all kinds of objects, which are desired to be protected against war gases.

If, for instance, meat, meat goods, fruits and vegetables are dipped into such a solution, or are coated or sprayed with it, after drying an entirely gas-tight layer is obtained, which layer protects these goods against war gases and which layer, on the other side, can be removed easily by washing with water before consumption.

In a manner known per se films and ribbons can also be made from such solutions, which films and ribbons can serve for packing provi-

sions which cannot be washed with water, such as bread, cake, and so on.

Further, these films can be used as intermediate layers in gas-masks, shoes and such articles.

Further indifferent materials can be incorporated into the protecting material, such as fibres, colouring matters, strengthening means, softeners, and preservatives. By these additions, it is possible to vary highly the properties of the films and ribbons made from the material.

As this particular material is dry and not sticky, it possibly is not necessary to cover a tissue impregnated with this material with outer layers, which lowers considerably the cost price of the gas-tight tissue. This, for instance, is to be used for persons who do not take actively in combatting war gas. On the other side, such a tissue, which is not provided with outer layers, could serve as port sails in ware and store houses for provisions. If, in consequence of a long use the gas-tightness is reduced, such tissues can be redressed again by reimpregnating.

The desinfection can also take place by cleaning by boiling, then by drying and reimpregnating.

If a tissue, provided with two waterproof outer layers, must be prepared, if is preferable also by this material to apply an intermediate layer of adsorbing material between the inner layer and the outer layers. This does not cause a better sticking it is true, but a greater strength of the tissue is obtained. Tissue, paper, fibres, wood or cork powder and such material here also can be used as adsorbing material.

The tissues to be treated according to the invention can be prepared from all known materials, to be worked into material. The choice will depend upon the particular properties which are wanted for the present gas-tight materials. For cheap fabrics, e. g., cotton will be chosen as raw material. For strong fabrics on the other hand, linen or Indian grass are preferable. Fabrics of artificial fibres can also be treated according to the invention.

It appears from the applications given above as examples that, in consequence of the present invention, now it is possible to give a real protection to everything that is desired to be protected against war gases, because the mass can be applied on, between or in anywhere and it can be given any form desired.

Example 1

A cotton fabric is coated at one side with latex, which is vulcanised thereupon. Then an aqueous solution of 35% of gum arabic, to which 10% of glycerol is added, is applied to the other side. With this the fabric is impregnated. Thereupon the excess of solution is removed, the tissue is dried somewhat by bringing it over a warm roll, after which the treated side of the fabric is covered with wood powder and after that is covered with a layer of rubber latex, which is either vulcanised in the known manner or is treated with an alcoholic shellac solution. A very flexible material, which gives absolute protection against chemical fighting means, is obtained, which even resists the action of mustard gas.

Example 2

As in example 1, a cotton fabric first is provided with a vulcanised layer of rubber on one side and thereupon impregnated with the solution mentioned in example 1. Now, a layer of a thickened solution is applied to the treated layer. After drying over a warm roll a new layer of fabric is applied to the last applied layer and after that the outer layer of vulcanised rubber is applied thereupon. A material which is very durable, hard-wearing and impervious to war gases is obtained.

Example 3

A cotton fabric is led through a solution of 40% of tragacant, to which 15% of glycerol is added, thereupon, after passage over a warm roll and after having been covered on both sides with a layer of paper, it is led through a solution of rubber latex and is then vulcanised. In this way a very cheap tissue is obtained, which is absolutely impermeable for all gases.

Example 4

A cotton fabric is treated on one side with a urea methanal artificial resin mass, capable of being hardened which is thereafter hardened.

After that the cotton is impregnated with a solution of 30% of a permanently water soluble artificial resin of the same or of other kind, not capable of being hardened, to which 20% of a mixture of equal quantities by weight of glycol and glycerol has been added. To this prepared layer successively three layers of fabric are applied, which are all treated in the way described, after which finally a thickened solution is applied which is covered with a layer of wood powder. Thereupon a layer of the above-mentioned artificial resin capable of being hardened, is applied to this layer, which resin finally is hardened. A rather thick and very firm tissue is obtained, which is gas-tight and adapted for many purposes, e. g. for airships, gas-tight holders, and so on, particularly for the durable tightening of shelters.

Example 5

100 gr. of tragacant are dissolved in 200 gr. of water with heating at 50–60° C. Thereupon 50 gr. of glycol is added and stirred until a homogeneous liquid is obtained. Then 8 gr. of boric acid is added. The solution thus obtained is used for impregnating and gives a dry and flexible gas-tight layer.

Example 6

120 gr. of gum arabic are dissolved in 250 gr. of water with heating at 60–70° C. After that 45 gr. of glycerol is added and is stirred, until a homogeneous liquid is obtained. After drying of the solution the same result is obtained as with the material according to example 5.

Example 7

A similar result as mentioned in Examples 5 and 6, is obtained by dissolving 50 gr. of permanently water soluble aniline methanal artificial resin not capable of being hardened with heating at 50–60° C. in 100 gr. of water and then adding 30 gr. of propylene glycol. After stirring a homogeneous liquid is again obtained, which can be used for impregnating fabrics and which yields a dry, flexible layer.

GERHARD VAN DER VEEN.

Published June 15, 1943 Serial No. 254,521

ALIEN PROPERTY CUSTODIAN

AQUATIC TORCH OR LIGHT BUOY

Antoine Thiebault, Marseilles, France; vested in the Alien Property Custodian

Application filed February 4, 1939

The object of the present invention consists in improvements made in the devices used for the automatic lighting of aquatic torches or light buoys which are more particularly intended for seaplanes for facilitating alighting on water, signalling and other operations, and in which a composition is used which serves for producing an illuminating flame, which composition is the object of French Patent No. 575,146 of the 29th December 1923.

Hitherto, at the moment of using these apparatus, it was necessary previously to tear off by hand the water-tight diaphragms in order to prepare the working of said apparatus. This operation, which is of the simplest nature per se, offers however a serious drawback, since in many cases and more particularly in aviation, the removal of the diaphragms by hand is sometimes difficult and dangerous owing to the time required for this operation, which is taken to the detriment of that of piloting, particularly if the pilot is alone and in danger.

Account must also be taken of the neglect to remove the diaphragms.

All these drawbacks and risks are now eliminated by the improvements made in these illuminating apparatus, the chief purpose of which is to eliminate any previous operation and to effect their lighting automatically.

Said improvements are more particularly characterized by diaphragms formed by water-tight materials of very small thickness and subjected to the movement of an actuating member which is itself subjected to the effects of the fall for causing them to be torn off and perforated.

Said improvements are shown in the accompanying drawings which are given by way of a constructional example of one of the embodiments of the object of the invention.

In said drawings:

Fig. 1 shows a longitudinal sectional view of the whole of the parts and elements forming an aquatic illuminating apparatus.

Fig. 2 shows a plan view and a sectional view along the line II—II of Fig. 3, of the arrangement of the partitions which hold in a normal position the composition serving for producing the illuminating flame.

Fig. 3 shows an outside view of the apparatus illustrated in Fig. 1.

The aquatic apparatus or torch of sufficiently streamline shape with tail fins, comprises a cylindrical body 1 which terminates at each of its ends by conical portions 2 and 3. On the inside, and in the upper part of the body 1, is located a water-tight chamber 4 which ensures the buoyancy of the apparatus in co-operation with weighting members 3*a* placed in the inverted cone 3.

The central part of the chamber 4 forms a cylindrical pipe 5 which opens on the upper end 6 of the apparatus.

In the lower part of the body 1 are arranged partitions 7 forming compartments, Figs. 1 and 2, which are intended to hold the illuminating composition in a normal position.

The central part of said compartments also forms a perforated pipe 5*a* placed in the axial extension of the pipe 5. A cover 8, which is likewise perforated, closes said compartments.

It is to this known arrangement that the improvements which characterize the invention apply. Said improvements more particularly consist in a small cylinder 9 without a bottom and having a perforated wall, which cylinder is fixed on the end of the conical portion 3. In said cylinder, at a predetermined height, is placed a diaphragm 10 which is preferably made of metal, is slightly curved outwardly and is of very small thickness, for example $\frac{1}{10}$ of a millimetre. The upper face of said diaphragm is in contact with a push member 11 secured to a rod 12 which carries at its upper part a tube 13, the slightly conical end of which forms a valve 14 of which the stem is formed by an illuminating jet 15 fixed on this perforated tube 13.

At the required instant, the rod 12 can move freely in the conduits 5 and 5*a*.

Towards the lower end of said rod 12, is fixed thereto by known means (welding), on the one hand a diaphragm 16 which hermetically closes an orifice 17 of large diameter provided in the central part of a cap-shaped member 18, the latter being secured to the end 19 which closes the conical portion 3 of the body 1, and on the other hand an illuminating jet 15, carried by the tube 13 and the rod 12, is adapted to bear on a diaphragm 20 that hermetically closes the upper orifice of the conduit 5 which opens at the top of the conical portion 2. The jet 15 passes inside a bush 21 which forms a seat for the valve 14.

A retracting spring 22 holds the valve 14 against the bush 21.

Thus constructed, the improved apparatus operates in the following manner:

Owing to its tail fins, the apparatus always falls in a vertical position; as soon as it touches the water, the diaphragm 10 is pushed back inside the cylinder 9 as would be a piston, moving, by

means of the push member 11, the rod 12 in the direction of the arrow A. This movement, which is indicated in dotted lines, has the effect of first of all tearing away the diaphragm 16 and uncovering the orifice 17, and then of perforating the diaphragm 20 by means of the jet 15. At this instant, the tension of the spring 22 causes the joining of the tube 13 forming the valve 14 against the bush or seat of the valve 21.

As the diaphragm 16 has been torn away, the water penetrates inside the apparatus up to the water line B.

The illuminating composition being moistened, the gas is produced instantaneously and penetrates into the perforated tube 13 and into the jet 15 where it ignites on contact with the air in accordance with the principle described in French Patent No. 575,146.

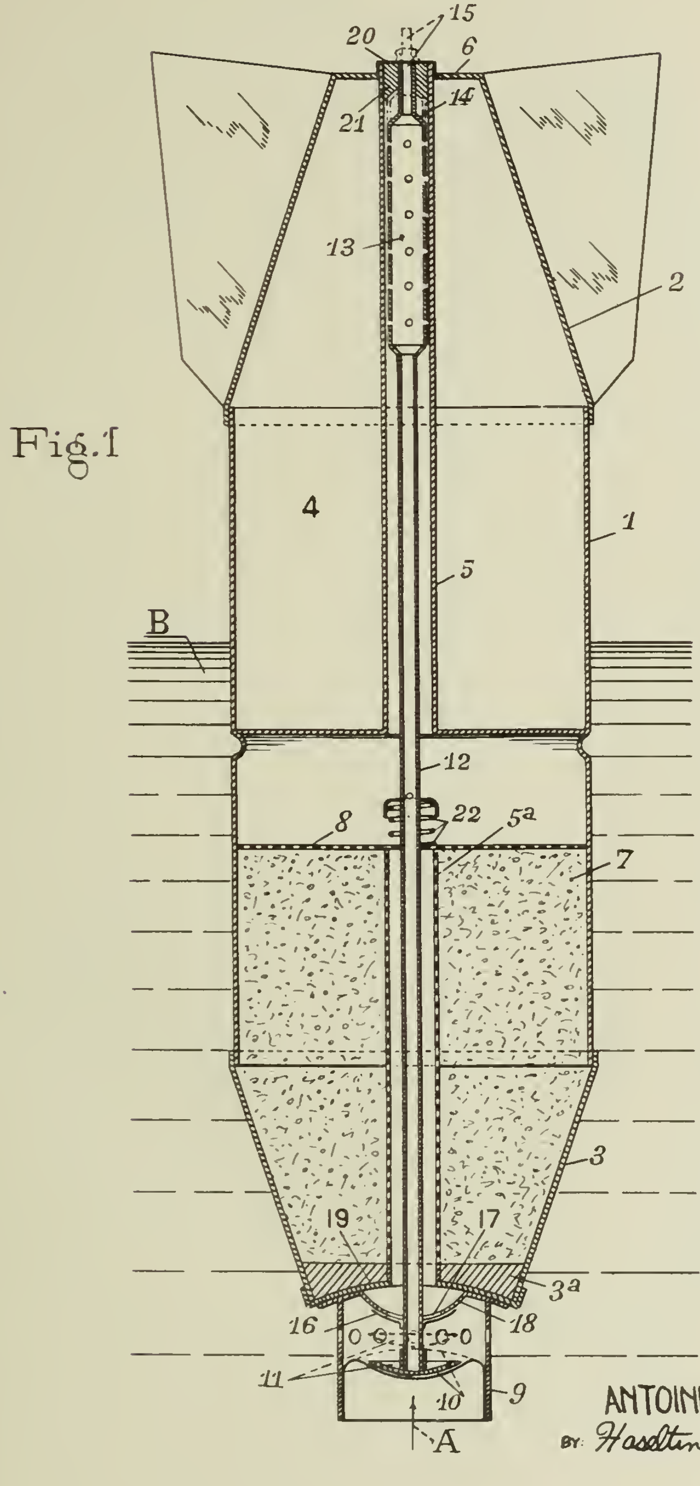
An automatic working is thus obtained which completely eliminates any previous and sometimes difficult manipulation. These improvements enable the apparatus to be left to fall freely without any precaution and ensure complete automaticity of working, by means of the appropriate shape of the apparatus, and by means of the special device described for the perforation of diaphragms which is obtained solely by the movement of a diaphragm which only operates at the instant of the impact against the water or under a predetermined hydrostatic pressure. Said improvements justify a most important advance in this kind of apparatus of which the shapes, the dimensions and the materials used for its manufacture may vary without for that reason changing the general arrangement of the invention which has just been described.

ANTOINE THIÉBAULT.

PUBLISHED
JUNE 15, 1943.
BY A. P. C.

A. THIEBAULT
AQUATIC TORCH OR LIGHT BUOY
Filed Feb. 4, 1939

Serial No.
254,521
2 Sheets-Sheet 1



INVENTOR:
ANTOINE THIEBAULT
BY: Haseltine, Lake & Co.
ATTORNEYS

PUBLISHED
JUNE 15, 1943.
BY A. P. C.

A. THIEBAULT
AQUATIC TORCH OR LIGHT BUOY
Filed Feb. 4, 1939

Serial No.
254,521
2 Sheets-Sheet 2

Fig.3

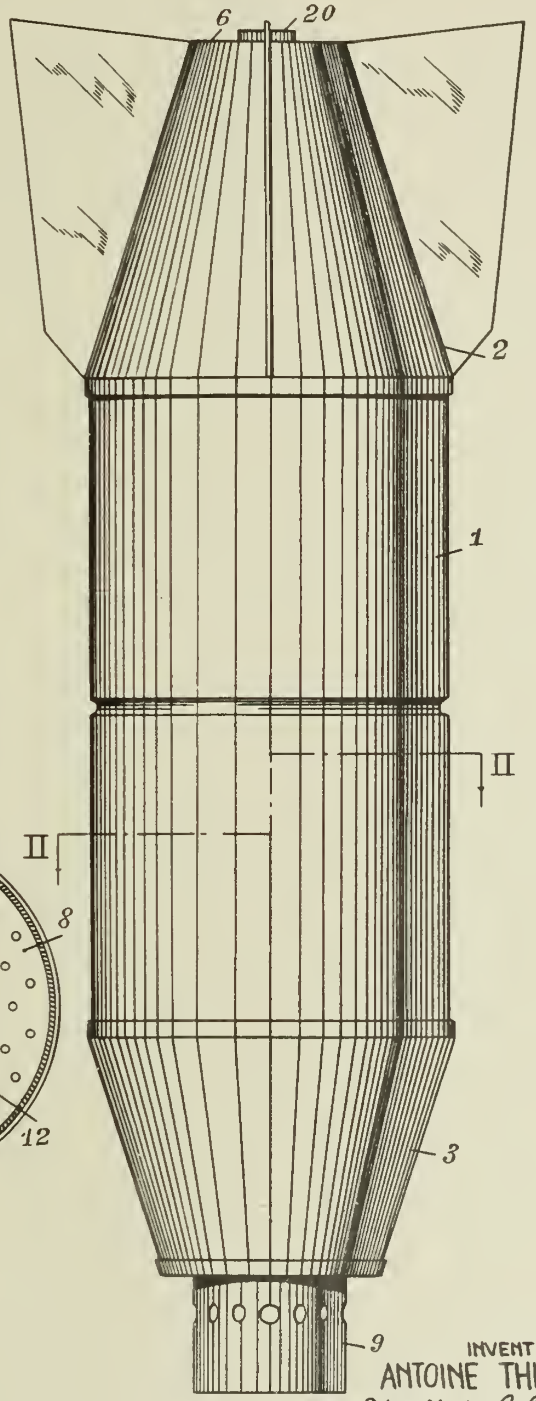
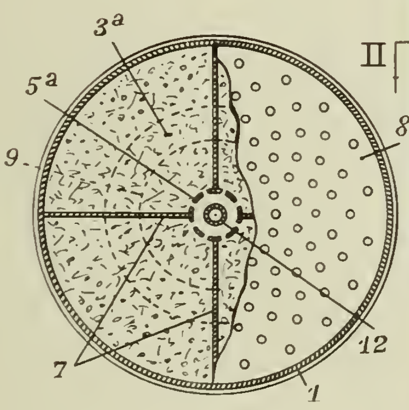


Fig.2



INVENTOR:
ANTOINE THIEBAULT
BY: Haseltine, Lake & Co.
ATTORNEYS

ALIEN PROPERTY CUSTODIAN

FLUID DELIVERY METERS

Emile Piquerez, Saint-Cloud, France; vested in the Alien Property Custodian

Application filed March 6, 1939

The present invention relates to fluid delivery meters or counters of the continuous type, in which the metering member is a rotor arranged in, and operated by, the liquid current.

It is known that known apparatus of this kind, whether of the purely mechanical type, of the electro-mechanical type or of the magnetic type, have the general inconvenience of having a reduced sensitiveness, in consequence of the braking action applied to the rotation of the turbine by the marking device, which indicates the volumes as a function of the number of revolutions of the rotor.

The present invention has for its object to provide a novel meter of the turbine type which radically eliminates this inconvenience, and which consequently possesses a maximum sensitiveness limited only by the minimum pivoting friction of the turbine.

To this end, the invention is essentially characterised by the use, in order to control the indicator, of a photo-electric cell and of a luminous pencil constructed so as, alternatively, to illuminate the cell and to be cut off at a frequency proceeding from the rule of rotation of the turbine under the action of the fluid current.

The output of the amplifier of the photo-electric cell is connected to a relay which, at each illuminating phase, or at each cutting off phase, according to the arrangement chosen, closes the feeding contact of an electro-magnet controlling the base wheel of a counter, the graduation of which is arranged as a function of the volume of liquid that flows between two successive phases.

In a particularly simple embodiment, the apparatus comprises a turbine, which is co-axial with the fluid conduit and is of the helicoidal type with one or more spirals turning in a glass cage. The luminous pencil is established across the interval comprised between the hub of the turbine and the said cage by means of a source of light external to the latter. The photo-electric cell is arranged on the opposite side of the cage in a suitable position, account being taken of the refractions of the luminous rays through the cage and also through the flowing liquid. The said luminous pencil is cut off at the passage of each spiral, that is to say, a number of times per revolution of the turbine equal to the number of spirals of the latter.

In the case of an opaque fluid, a turbine rotating in a glass cage can still be used with a luminous pencil, which is arranged in such a manner as normally to be cut off by the mass of the said fluid but, at the time of the passage of a spiral or blade of the turbine, to be directed towards the photo-electric cell by means of a small reflecting surface integral with the spiral or blade and rotating in close contact with the internal cylindrical wall of the cage.

The annexed drawings show, by way of example, one embodiment of the invention.

Fig. 1 shows the complete apparatus, partly diagrammatically and partly in sectional elevation, on the line A—A—A—A in Fig. 2;

Fig. 2 is a fragmentary plan view partly in section, at the level of the line B—B in Fig. 1; and

Fig. 3 is a partial and diagrammatic plan view of a modification of the preceding construction for use in the case of an opaque fluid.

Referring to the drawing, the apparatus comprises a turbine 1, of the axial type, for example, and consequently mounted on the axis of the fluid conduit 2^a, 2^b. The turbine is supported in a tubular casing 3 inserted between the two sections 2^a, 2^b of the conduit. The ends of the shaft 1^a of the turbine forming pivots are advantageously carried, in the usual manner of clock-work pivots, in stones housed at 4, 4 on pierced supports 5, 5 in the interior of the casing 3, so as to reduce friction to a minimum.

In the present construction, the turbine comprises a single spiral which rotates without play in the internal conduit of the casing 3, the part of the latter housing the turbine consisting of a glass tube 3^a, hermetically encased at its ends in two metallic parts 3, 3 joined in a fluid-tight manner, in any suitable way, with the two sections 2^a, 2^b of the fluid conduit.

In the inlet of the turbine there is advantageously disposed a fluid current corrector or breaker-jet 6 which eventually, in a case in which the apparatus is branched immediately following a bend in the fluid conduit, will cause the fluid stream to flow parallel to the axis of the turbine.

The space between the shaft or hub 1^a of the turbine and the internal wall of the glass case 3^a is traversed by a luminous pencil from a lamp 7, arranged to illuminate a photo-electric cell intermittently in dependence on the delivery of fluid through the turbine, that is to say, in accordance with the rule of rotation of the turbine and as a function of the number of spirals of the latter. In the present construction, in which the turbine comprises a single spiral only, the luminous pencil will thus be cut off once per revolution and, in this connection, it will be noticed that the number of spirals of the turbine is only limited by the condition that the

luminous pencil should only meet a single spiral at a time. The whole of the photo-electric cell with its accessories (amplifier) represented diagrammatically is designated by 3 on the drawing. The luminous pencil advantageously is limited by means of a diaphragm 9 provided with an operculum 10 or concentrated by means of an optical condenser.

In Fig. 2 it is assumed that the axis of the luminous source is aligned with the axis of the receiving cell but, in reality, these two members are disposed one with respect to the other so as to take into account the refraction of the light through the glass of the tube 3^a and, eventually, by the fluid which flows into the conduit.

The lamp 7 is mounted in a support 11 which is fixed, for example, against a plane face, in the form of a ring 3^b on the side of the metallic parts 3 of the casing of the turbine, and maintains the diaphragm 9 in position at the same time.

The cell and its accessories can be mounted, for example, on a seat 12 integral with the lower member 3 of the casing.

The apparatus as just described is closed in a light-tight casing (not shown), which prevents the action on the cell of daylight or any other source but the lamp 7.

The current furnished by the photo-electric cell is duly amplified and feeds a relay 13 which itself serves to feed the counter-mechanism proper, either at the time of the lighting phases, or at the time of the cutting off phases. On the drawing, the parts are shown as being arranged to operate according to the second method, that is to say, each time that the luminous pencil is cut off, the relay 13 releases its armature 14 which, under the action of a return spring 15, bridges contacts 16 and closes a circuit by which an electro-magnet or a solenoid controlling the counter is fed. The illustrated example of the circuit comprises a solenoid 17 having a plunger core 18, which is articulated to a click 19 adapted to operate the base wheel 20 of a drum counter 21. A spring 22 ensures the return of the click 19 and of the core 18 and another click 23, such as a resilient blade, ensures the retention of the base wheel.

It will be understood that in the present case the base wheel advances by one tooth for each revolution of the turbine 1, this corresponding to the passage through the turbine of a predetermined volume of fluid.

The number of teeth of the base wheel and the transmission between the latter and the first graduated drum or the first indicating wheel are naturally established in dependence on the units (litres or others) indicated by the first drum or the first wheel. It will be understood that the measurement for a pipe of given diameter will be the more precise as the delivery corresponding to an operation of the counter is smaller, the maximum precision being obtained by providing the turbine with a maximum number of spirals compatible with the observance of the condition indicated above, that is to say, that the luminous pencil shall never encounter more than one spiral at a time.

In the case of the metering of the delivery of an opaque fluid, apparatus of the same kind as the preceding can be used but with a different relative arrangement of the luminous source and the photo-electric cell. In this case, the luminous pencil f, Fig. 3, refracted at f^1, will be made in such a manner as to be cut off normally by the mass of the opaque fluid. Each spiral or blade 1 of the turbine will be provided, however, at the height of the plane of the pencil with a small rim 24 having a reflecting surface which, during the passage of the spiral, encounters the pencil and causes it to pass from f^2 to f^3 in the direction of the photo-electric cell 8.

In this sense, if the turbine only comprises a single spiral, the illuminating phases will be shorter than the cutting-off phases and, in consequence, it will be of interest to arrange the relay 13 in a reverse manner to that of Fig. 1, so that it closes the circuit of the electro-magnet of the counter during the phases of attraction of its armature 14.

It will be noted that the meter of the present invention operates exactly in the same manner in the same direction of flow of the fluid.

It goes without saying that the counter mechanism proper can be arranged either for counting positively or for deducting from a quantity marked in advance by the indicator members.

It will be understood that the invention is not limited to the constructional methods described and shown, of which it comprises all modifications. Any other type of turbine can be employed and the luminous pencil may be arranged out of the zone swept by the turbine proper, in such a manner as to cut the path of any member integral with the latter.

EMILE PIQUEREZ.

PUBLISHED

JUNE 15, 1943.

BY A. P. C.

E. PIQUEREZ

FLUID DELIVERY METERS

Filed March 6, 1939

Serial No.

260,164

Fig. 1

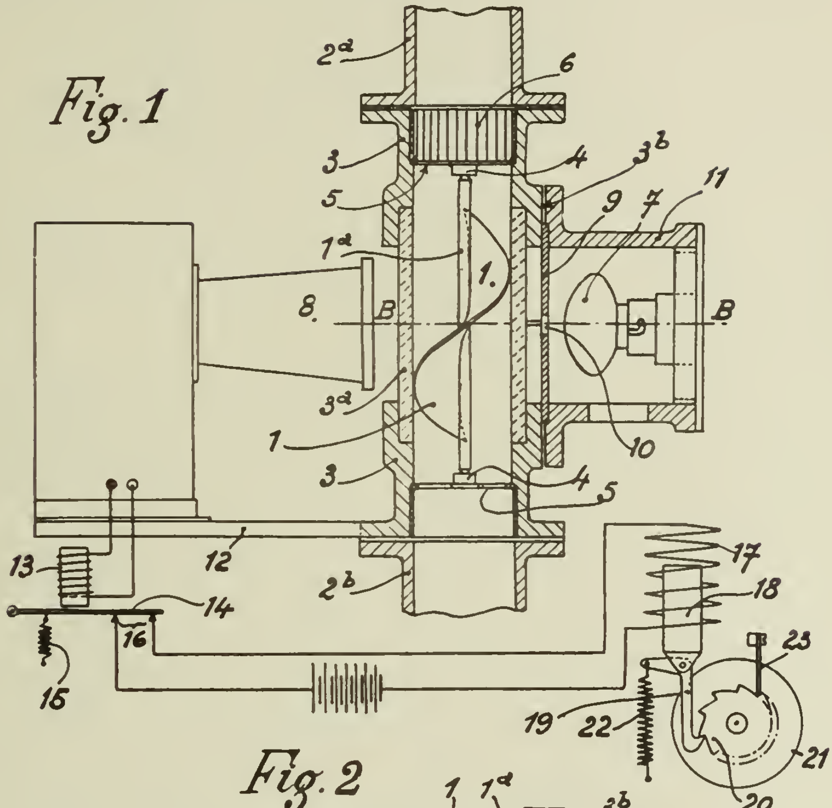
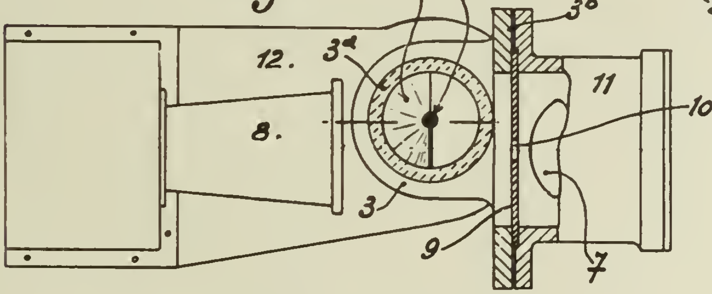


Fig. 2



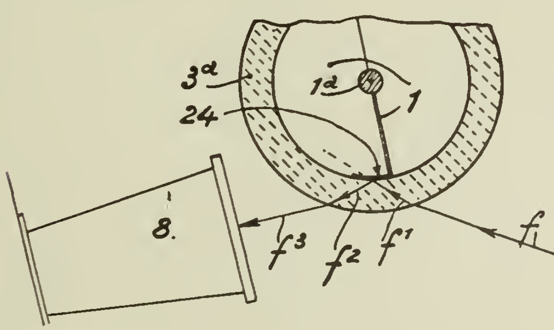


Fig. 3

Inventor
Emile Piquerez
By Sommers & Young
Attys

Published June 15, 1943

Serial No. 262,232

ALIEN PROPERTY CUSTODIAN

METHOD FOR PREPARING NON-INFLAMMABLE PAINTS, LAC-VARNISHES, LACQUERS, COATINGS AND THE LIKE

Johannes Hubertus Casparus Penners, Amsterdam, Netherlands; vested in the Alien Property Custodian

No Drawing. Application filed March 16, 1939

This invention relates to a method for preparing non-inflammable paints, lac-varnishes, lacquers, coatings and the like, and also to the products obtained according to the method of my invention.

There have been proposed several methods for making paints, lacquers and the like in order to give them fire-resisting properties consisting in adding silicates, pyrolytic decomposing salts, such as ammonia-phosphates and the like.

I have found now that there is a better and more simple method for giving fire-resisting properties to all types of painting, lacquers, varnishes, coatings and the like.

According to my invention I add hygroscopic salts, such as chlorides of metals, such as Ca, Al, Mg and the like. I also may use mixtures of several hygroscopical salts as follows from the examples given in this specification. It has appeared that it is possible oil-paints and the like as well as nitro-cellulose-paints, -lacquers, to prepare according to my invention so that same are non-flammable and fire-resisting without undesirable effects on the other properties of the same.

Several paints, such as oil-paints, contain emulsifiers in order to hold the pigments divided in the fluid medium. These emulsifiers may also disperse the hygroscopic salts. If the emulsifiers in the paints to be treated are insufficient to bring the hygroscopic salts in a finely divided state, emulsifiers may be added together with the salts. It is not important in what manner the salts are added, but it is necessary that the salts are dispersed in the paints as well as possible. In the case that oil-paints are used a concentrated solution of the hygroscopic salts may be stirred into the paint. The salts may be used in a watery solution. It is possible that the good properties of paints and lacquers are lost if water or watery solutions are added. In that case the hygroscopic salts may formerly be dissolved in solvents, such as alcohol, actene and the like. I have found that it may be advantageous to use a solution of the salts in alcohol as the solvent will evaporate after the paints have been rubbed out. Furthermore it has appeared that the salts are better dispersed in using an alcoholic solution. In the case that the paint or varnish contains a too small quantity of emulsifiers, glairs, glues, resins and the like may be added whether alone or together with the hygroscopic salts to the paints to be treated. As appears from the following examples the amounts of the hygroscopic salts to be added may be varied dependent on the composition of the paints. In particular I have found that the best results may be obtained with the chlorides of magnesium or calcium, alone or mixed together. It was unexpected that it was possible to use hygroscopic salts in paints or the like as the man skilled in the art would suspect that the hygroscopic properties would lead to a moisty surface. However, I have found that these drawbacks need not to occur and that a good paint, lacquer and the like may be made, giving a dry surface. Of course, the more hygroscopic salts are added to a paint, the more the paint will have hygroscopic properties and the more it will be possible that moisture of the air will be attracted by the surface of the paint after being rubbed out. In order to overcome the possibility of the surface of the paint or the varnish becoming moisty in any case I can add "indifferent" salts, such as carbonates, as calcium-carbonates.

I am aware that it is very difficult to give a correct explanation of the effect of the "indifferent" salts, but I suppose that the "indifferent" salts absorb the moisture attracted by the hygroscopic salts. It has appeared advantageous to use a pyrolitic decomposing salt, as "indifferent" salt, whereby the fire-extinguishing properties of the pyrolitic salts may help to make the treated paint non-inflammable and/or fire-resisting. Besides the chlorides of calcium and magnesium, as mentioned above, I may use the chlorides and sulphates of alluminium, ammonnium, chromium, iron and/or manganese, alone or mixed together. In order to illustrate my invention the following examples are given, viz:

Example 1

A paint for coating aircraft-wings having the following composition:

	Parts
Nitro-cellulose (10 parts dry to 4,1 part solvent)	141
Aceton	15
Benzene	50
Ethyl-alcohol	20
Ethyl-acetate	15

is divided in portions of 50 grams, of course each portion being very inflammable.

(a) To 50 grams of the above mentioned paint is added 12 ccm of a solution of 120 grams NH_4Cl and 380 ccm water. After this mixture has been rubbed out it will appear that same is not inflammable as the chloride used is not hygroscopic.

(b) To 50 grams of the above mentioned paint is added 12 ccm of a solution of 100 grams $(NH_4)_2HPO_4$ in 200 ccm water. Though a known pyrolitic decomposing salt has been used the paint

obtained according to this example is not fire-resisting.

(*c*) To 50 grams of the mixture of example 1 is added 12 ccm of a solution of 200 grams $CaCl_2$ in 100 ccm methyl-alcohol. This mixture is non-inflammable as a hygroscopic salt has been used.

(*d*) In order to show the effect of the adding of an "indifferent" salt, to 50 grams of the paint according to example 1 is added 12 ccm of a solution of 200 grams $CaCl_2$ in 100 ccm methyl-alcohol and 3 grams $CaCO_3$. In comparing example *d* with *c* after the paints have been rubbed out it will be seen that the surface of the paint according to *d* will rest absolutely dry whereas the surface of the paint *c* becomes easier moisty, dut to the fact that the mixture according to *c* does not contain a carbonate as an "indifferent" salt.

(*e*) To 50 grams of the paint according to example 1 is added 12 ccm of a solution of 200 grams $CaCl_2$ in 100 ccm methyl-alcohol and 3 ccm formaline. This mixture has good non-inflammable properties, but it will appear that due to the fact that formaline is added, the chloride has been better dispersed in the mixture.

(*f*) To 50 grams of the paint according to example 1 is added 12 ccm of a solution of 200 grams $MgCl_2$ in 200 ccm methyl-alcohol. This mixture has about the same non-inflammable and fire-resisting properties as the mixture according to *c*.

(*g*) To 50 grams of the paint according to example 1 is added 12 ccm of a solution of 200 grams $MgCl_2$ with 200 ccm methyl-alcohol and 3 grams $CaCO_3$. This mixture has about the same properties as that according to *d*.

(*h*) To 50 grams of the paint of example 1 is added 12 ccm of a solution of 200 grams $MgCl_2$ in 200 ccm methyl-alcohol, together with 3 grams $CaCO_3$ and 3 ccm formaline. This mixture has about the same properties as that according to *e*.

Example 2

A common oil-paint consisting of linseed-oil, quick drying-oil, zinc-white, a siccative and a red coloured pigment, is used. As described in example 1 to portions of 50 grams are added 12 ccm of the solutions called under *a* to *h*. The resulting mixtures have about the same properties as to fire-resistancy as the mixtures specified under *a* to *h*.

JOHANNES HUBERTUS CASPARUS PENNERS.

Published June 15, 1943

Serial No. 262,728

ALIEN PROPERTY CUSTODIAN

PRODUCTION OF SUBSTITUTED AROMATIC SULPHONIC ACIDS

Fritz Guenther, Heidelberg, and Hans Haussmann, Mannheim, Germany; vested in the Alien Property Custodian

No Drawing. Application filed March 18, 1939

The present invention relates to the production of substituted aromatic sulphonic acids.

We have found that products having very valuable industrial properties are obtained by esterifying hydroxyalkyl ethers of phenols, naphthols or aliphatic-aromatic alcohols with high molecular weight aliphatic carboxylic acids or the derivatives thereof, which ethers contain sulphonic acid groups in the aromatic nucleus, or derivatives of the same, or by esterifying hydroxyalkyl ethers, free from sulphonic acid groups, of phenols, naphthols or aliphatic-aromatic alcohols with saturated aliphatic carboxylic acids and introducing sulphonic acid groups into the resulting esters by sulphonation. The term aliphatic carboxylic acids in the present case is intended to comprise open chain aliphatic as well as cyclic aliphatic carboxylic acids.

As acids suitable for the esterification, which may be carried out in any known manner, there may be mentioned high molecular weight aliphatic or cycloaliphatic carboxylic acids having at least 8 carbon atoms or their esterifiable derivatives, such as acid chlorides, acid anhydrides or esters, with low molecular weight alcohols, as for example methyl alcohol. The salts of the said carboxylic acids may also be used when mineral acid esters of the said hydroxyalkyl ethers are used for the esterification. As carboxylic acids there may be mentioned for example capric acid, lauric acid, myristic acid, palmitic acid, stearic acid, montanic acid or mixtures of such acids, such as are obtained for example by saponifying fats or waxes or by oxidizing high molecular weight aliphatic hydrocarbons. Naphthenic acids or hydrogenated resinic acids may also be used. Unsaturated fatty acids and/or fatty acids containing hydroxy groups may also be used if the hydroxyalkyl ethers or their mineral acid esters, as for example hydroxyalkylphenyl ethers or chloralkylphenyl ethers, which are used for the esterification already contain sulphonic groups.

As hydroxyalkyl ethers of phenols, naphthols or aliphatic-aromatic alcohols there may be mentioned for example alkylene glycol monophenyl-, -tolyl- or xylyl ethers or alkylene glycol benzyl ethers. In particular, the ethers of ethylene glycol or of propylene or butylene glycols or of glycerine are suitable. Hydroxyalkyl ethers of polyalkylene glycols and phenols, naphthols or aliphatic-aromatic alcohols, as for example diethylene glycol monophenyl ether, may also be used as initial materials.

The sulphonation is carried out under the conditions known for the production of true sulphonic acids of the aromatic series while employing sulphuric acid, oleum, chlorsulphonic acid or SO_3 in the presence or absence of solvents or diluents, such as carbon tetrachloride, trichlorethane, nitrobenzene, diethyl ether, pyridine and/or with the addition of organic or inorganic acids, acid anhydrides or acid chlorides capable of binding water.

In the manner as described there are obtained true sulphonic acids of the general formula:

$$(R—CO—O—(A—O)_n—R'—SO_3H)$$

wherein R is a high molecular aliphatic radicle, A is a low molecular alkylene radicle, n is a whole number and R′ is an aryl or an aralkyl radicle. The said products may be used with advantage, as such or in the form of their salts, in neutral, alkaline or acid baths or in hard water. They have in particular a high cleansing, wetting, dispersing and solvent power.

The following example will further illustrate how the said invention may be carried out in practice, but the invention is not restricted to this example. The parts are by weight.

Example

274 parts of palmitic acid chloride are introduced into 235 parts of glycol monocresyl ether and heated for a short time to 60° C. The resulting palmitic acid ester is then sulphonated with 300 parts of sulphuric acid monohydrate at from 35° to 40° C. The sulphonation mixture is poured onto ice and neutralized with caustic soda solution and then worked up in usual manner. A product having a good washing power is this obtained.

Instead of palmitic acid chloride there may also be used a corresponding amount of naphthenic acid chloride, a product having similar properties being obtained.

An analogous product is obtained by condensing palmitic acid chloride with the sulphonic acid of glycol monocresyl ether containing the sulphonic acid group attached to the aromatic nucleus of the cresylic radicle.

FRITZ GUENTHER.
HANS HAUSSMANN.

[illegible]

[illegible]

Published June 15, 1943

Serial No. 262,847

ALIEN PROPERTY CUSTODIAN

PAD, NOTE-BOOK OR CALENDAR

Abraham Jakób Grossfeld, Krakow, Poland;
vested in the Alien Property Custodian

Application filed March 20, 1939

Pads, note-books or calendars known hitherto, have their backs glued with a hard glue (i. e. with a glue hardening after drying) or clasped with wires. The disadvantages of these pads, note-books or calendars consist in that the glued back is subjected to breaking and crumbling when the pad is completely opened i. e. when the pieces of paper are opened at an angle of 180°; when the back is clasped with wires the sheets of paper cannot be drawn out completely, because the wires retain strips of paper which cause an unesthetic appearance of the pad and besides diminish its usefulness as a note-book.

The principle of the above invention consists in that the back of the pad, note-book or calendar is covered with an elastic mass, e. g. of rubber, latex, resin or their mixture, eventually with an addition of glue or dextrin. Due to these means the pad, note-book or calendar according to the invention is free from the above mentioned disadvantages, as its back is elastic and does not break when opened. This back of elastic mass is showed in *b* in the accompanying drawing.

Example of execution of elastic mass: 75 parts by weight of 40% solution of latex is mixed with 25 parts by weight of glue in dissolved state in 80° C. Atfer cooling to room-temperature the liquid is ready for use i. e. to be brought on the back of the pad, note-book or calendar.

ABRAHAM JAKÓB GROSSFELD.

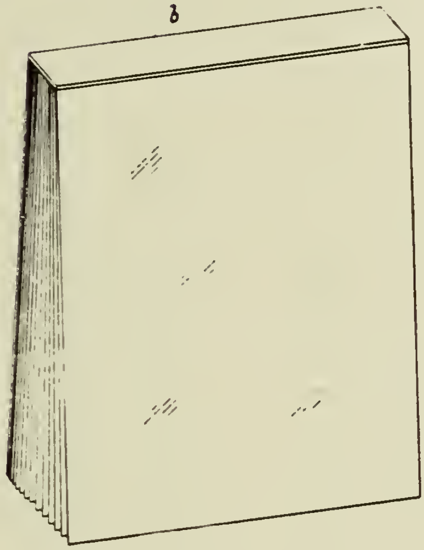
PUBLISHED
JUNE 15, 1943.
BY A. P. C.

A. J. GROSSFELD

PAD, NOTE-BOOK OR CALENDAR

Filed March 20, 1939

Serial No.
262,847



INVENTOR
Abraham J. Grossfeld
BY
Frederick E. Hahne

Published June 15, 1943 Serial No. 266,701

ALIEN PROPERTY CUSTODIAN

METHOD OF MAKING CREAM OF TARTAR

Isaac Braun, Beregszasz, Hungary; vested in the Alien Property Custodian

No Drawing. Application filed April 7, 1939

This invention relates to an improved method of making cream of tartar.

As it is known cream of tartar is obtained from the wastes of the making of wine, particularly from the lees or dregs of wine. The commercial crude cream of tartar is a product with a rather varying content of potassium bitartrate the value of which greately depends on the quantities and nature of the impurities contained therein besides the potassium bitartrate. The making of the cream of tartar is based on its very different solubility in cold or hot water respectively. The potassium bitartrate content of a saturated aqueous tartar solution will amount to 5,85 grms of potassium bitartrate in 100 ccms of solution if the temperature of the latter is of 100° C whereas it will amount to only 0,38 grms to the same volume if the temperature is of 10° C. In making cream of tartar the raw material, such as lees or dregs or other sediments of wine, as a rule in a pressed or dried state, further husks of grapes, residues of the distillation of said raw materials, etc., is boiled with water and the hot liquid containing besides the cream of tartar water-soluble albumines, carbohydrates, coloring matter, etc. is separated from the yeast cells and other suspended matter by filtration. The filtrate is then allowed to cool down to bring about the crystallisation of the cream of tartar. The filtration of the hot liquid gives much trouble, and the filtrate yields a very impure product. The filtration is achieved as a rule in steam-heated filter presses. These presses with the necessary attachments such as pumps, clarifying and decolorating devices, etc. are rather expensive, and their manipulation requires skilled workmen so that a commercial crude cream of tartar of good quality could only be obtained in large scale manufacture.

The process according to the invention enables the particularly economic recovery of a crude cream of tartar of best commercial quality by means of a very simple apparatus so that the working up of the wastes of wine-making is made to pay even if done on a small scale, and in less extended wine-growing countries.

The term "wastes of wine-making" as it is used within the present specification includes in addition to pressed, unpressed or dried sediments or lees or dregs of wine also husks of grapes, pomace and the like as well as the residues of the distillation of these wastes.

It has been found that the expensive filter presses hitherto employed can be dispensed with and the filtration be carried out in an easy, cheap and most effective manner with the use of a heated sand-filter, the filtration yielding in one single working operation a relatively pure filtrate from which a commercial crude cream of tartar of best quality will crystallise. By suitably selecting the filtering sand, sorting and arranging it in layers according to the size of its grains wherein also adsorbent substances such as infusorial earth, grained charcoal etc. may be employed it is possible to free the filtrate from at least part of some undesirable components, among others in particular from coloring matters. The term "sand filter" is to be understood quite generally as a filter comprising a filling consisting of natural sand such as quartz sand, pumice and the like, or artificial sand such as powdered and sieved glass, slags, rocks etc., or mixtures or alternating layers of the said materials; this filling is preferably supported by an undermost layer of gravel.

The heating of the filter is preferably done by means of steam passed through heating pipes or a coil arranged in the filtering material. The pipes or coils may be made of lead for instance. The heating, i. e. the supply of the steam is so regulated as to keep the temperature of the hot liquid passing through the filter constantly at about 100° C. Instead of steam other heating media such as furnace gases, heated liquids etc. may equally be employed.

The filter, at its simplest, can be constructed by providing in a wooden vat, with an outlet at its bottom, between two perforated partitions, undermost a layer of gravel and above the same two or more layers of sand having different grain sizes.

The somewhat desiccated yeast cells collecting on the surface of the filter can be removed in the form of a coherent layer. This is done at suitable intervals whereby a thin layer of impure sand sticking to the yeast cell layer is removed too, and has to be made up from time to time by fresh sand.

The filtration can also be done in two stages, although still in one working operation, by providing two sand filters above each other, spaced apart to some extent to allow the liquid to collect between the two of them. The first, i. e. the pre-filter, need not comprise more than one sand layer arranged, for instance, in a tiltable frame above the main filter. In this case the yeast cells and part of the other solids will be retained by the pre-filter which from time to time can be removed as a whole to be replaced

by fresh sand. Preferably the pre-filter and the space where the liquid collects are heated too.

Example.—100 kgs of pressed lees of wine having a water content of 60% and a total tartaric acid content or 12,2% (after Goldenberg) were distributed in boiling water, being stirred, the liquid was diluted by the addition of water to a volume of 350 litres, and boiled for one and a half hour. The hot liquid was then passed through a sand filter having a surface of 5 sq. metres, and being equipped with a pre-filter as described above. The filter had previously been heated to 110–120° C. and was kept approximately at this temperature during filtration. After two hours the filtration was completed. The filtrate of a light yellow color was allowed to stand for three days in a cool room. The weight of the crystallised product separated, freed from the mother liquor and dried amounted to 14.1 kgs, with a tartaric acid content of 68,2%, corresponding to a potassium bitartrate content of 85,5%. The color of the product was a grayish white. The mother lye could be utilized in the next operation to dilute the lees of wine, a measure that may be repeated several times.

The process according to the invention can advantageously be combined with the production of brandy and the like from the wastes of winemaking, the residues of the distillation of said wastes being repeatedly extracted with water, and the solution passed through the sand filter.

The temperature and supply of the heating steam can be so regulated as to cause some of the water of the liquid passed through the filter to evaporate. The rising steam sweeps out the spaces between the sand grains and thus acts to clean the filter.

ISAAC BRAUN.

Published June 15, 1943 Serial No. 266,723

ALIEN PROPERTY CUSTODIAN

HYDRAULIC POWER TRANSMISSION APPARATUS

Piero Mariano Salerni, Cox Green, near Maidenhead, England; vested in the Alien Property Custodian

Application filed April 8, 1939

This invention relates to hydraulic power transmission apparatus of the kind in which an impeller or driving member having ducts between vanes drives a turbine or driven member by means of liquid, and in which the torque imparted by hydraulic means to the turbine is or can be substantially greater than that imparted to the impeller whereby transmission of power may be effected by hydraulic means at a torque ratio or ratios substantially greater than the ratio of 1 to 1 independently of any associated mechanical change speed gearing. This invention is concerned with the design of the impeller.

According to this invention the impeller has ducts, whose outlets are situated in the outer part of the circuit (i. e. in that part of the circuit in which the direction of flow has an axial component and which is more remote from the axis of rotation than the parts wherein the direction of flow is radial) and of which ducts at least a substantial part is so constructed that the flow of the liquid therein remains stable (i. e. without objectionable eddies or turbulence) at the velocities obtaining during transmission of a substantial proportion of the full power for which the apparatus is designed at a torque ratio higher than 1 to 1.

Such a construction gives increased efficiency of transmission. The greater the length of the part so constructed the higher will be the efficiency and in any case such part must be substantial, i. e. long enough to give, in any particular apparatus, the required degree of efficiency.

In order that the flow in a duct or a part thereof shall tend to remain stable, its cross sectional area must be progressively reduced in the direction towards the outlet and it must be non-divergent (i. e. any normal cross section if superimposed on any normal cross section more remote than itself from the outlet will not overlap the same) or nearly so. The degree to which divergence can be permitted without causing the flow to become unstable depends upon the size and capacity of the apparatus and the nature of the liquid employed.

Preferably the ducts of the impeller are made non-divergent up to or nearly up to the outlet and preferably from a point at or near the inlet, and preferably the cross sectional area is progressively reduced throughout such length.

The cross sectional area may be made to decrease in the case of a tetragonal duct either by causing both pairs of opposite walls to converge or by keeping one pair parallel and causing the other pair to converge. If the liquid used has a high viscosity, e. g. as in the case of common engine lubricating oil, if one pair of opposite walls has a convergence of 5° while the other pair remains parallel, a substantial advantage is obtained. Up to a limit (which is at least 15°) the greater the degree of convergence the better will be the result.

The construction of the apparatus itself imposes limits to the possible amount by which the cross sectional area can be reduced towards the outlet. Thus the outlet must not be unduly constricted as otherwise the liquid will not be able to circulate sufficiently freely to transmit power efficiently. Moreover, the permissible largeness of the inlet is limited by considerations of the design of the circuit, since there must not be inordinate discrepancies in size between the dimensions of the channel through which the liquid is delivered to the impeller and the inlet of the impeller.

In the preferred construction the ducts have their outlets at the part of the circuit furthest away from the axis of rotation, so that the liquid issues therefrom in a direction having no radial component. In the preferred construction the ducts extend throughout practically the full radial dimension of the circuit and are curved also towards the inlet. The radius of the outside curve preferably at no point exceeds about twice the radius of the inner curve as otherwise there might be a tendency to eddying and turbulence from this cause. This requirement also, therefore, imposes a limit on the permissible largeness of the inlet.

The reduction of cross-sectional area towards the outlet is preferably as great as possible consistent with the above considerations.

The inlet and outlet of each duct are preferably substantially tetragonal, but from the inlet towards the middle portion of the duct the corners are preferably progressively rounded and the duct is preferably made again progressively to approach the tetragonal form towards its outlet.

Of the non-divergent part of each duct that portion which lies nearer to the inlet can be made non-divergent by progressively thickening the vanes of the impeller (i. e. the parts forming the walls separating a duct from adjoining ducts) in the direction towards the outlet. The vanes can be made integral with the impeller but it is convenient to make them separately and to assemble them upon the body of the impeller. Preferably the cross-sectional area is simultaneously progressively reduced and preferably this is ac-

complished by causing the remaining walls of the duct to converge.

It is preferred to form the outlet of each duct in such a manner that the stream issuing from a duct becomes merged gradually with those issuing from the adjoining ducts without objectionable eddying or turbulence. In order to achieve this the thickness of the vanes must be progressively decreased towards the outlet. This can be accomplished, while maintaining non-divergence, by turning the vanes as they approach the outlet. The turn must be backwards relative to the direction of rotation. Preferably this backwards turn takes place only in that portion of each duct of the impeller which lies in the outer part of the circuit and preferably in that portion the turn is sufficient to cause the walls constituted by the vanes to converge. Preferably the vanes are radially disposed elsewhere. It will be understood that the extent to which the vanes are turned backwards must not be so great that power is no longer efficiently transmitted (the optimum angle to which the vanes are turned relative to the direction of rotation usually lies between 30° and 60°) and therefore if the vanes are turned backwardly much before they approach the outlet of the ducts, since the thickness of the vanes can only be got rid of without divergence by further backward turning, the opportunity for so doing is correspondingly reduced.

The accompanying drawings show a typical embodiment of the invention.

Figure 1 is a side view of the liquid circuit.

Figures 2, 3, 4 and 5 are cross-sections of a duct on the lines of A—A, B—B, C—C and D—D respectively of Figure 1.

Figure 6 shows the cross-sectional areas of the duct sections of Figures 2, 3, 4 and 5 superimposed.

Figure 7 is a development of a vane on the line X—Y of Figure 1.

Figure 8 is a development of one duct on the line X—Y of Figure 1.

Figures 9, 10, 11, 12, 13 show the cross-sectional area of the duct on the lines *d—d*, *c—c*, *b—b*, *a—a* and *e—e* of Figure 8, which correspond to the lines D—D, C—C, B—B, A—A and the outlet, respectively, of Figure 1.

Figure 14 shows the cross-sectional areas of the duct sections of Figures 9, 10, 11, 12 and 13 superimposed.

Figure 15 is a development of a vane having an extension at the inlet.

Figure 16 is a development of a duct between two vanes as shown in Figure 15.

In Figure 1, **1** is the impeller with which alone this invention is concerned. **2** is the turbine and **3** is the reaction member. When the impeller **1** is rotated by any prime mover, liquid flows therein by centrifugal action from the inlet **4** thereof to the outlet **5** thereof whence it is discharged into the inlet of the turbine through which it flows in a radially inwards direction imparting rotational movement thereto. The outlet is situated in the outer half of the circuit, i. e. on that side of the line B—B which is remote from the axis of rotation.

The outer and inner walls of the ducts in the impeller are formed by the members **9** and **10** and the side walls are formed by the vanes **11**, **12**. **7** and **8** are rivets securing these vanes to the members **9**, **10**.

At the inlet (Figure 5) the vanes are thin and the cross-sectional area of the ducts of the impeller is at a maximum. The thickness of the vanes is thereafter progressively increased as shown in Figures 4, 3 and 2 so as to maintain the walls of the ducts formed by the vanes **11** and **12** non-divergent, notwithstanding that the vanes are extending radially outwards from the axis of rotation. The walls **9** and **10** are progressively brought closer together to reduce the cross-sectional area, the height of the vanes being accordingly reduced. Figure 6 shows the successive cross-sections of the duct super-imposed and it will be seen that the side walls remain the same distance apart while the top and bottom walls are converging. The vanes have been thickened as shown in Figure 7 from the point **13** at the inlet to the point **14** corresponding to the line A—A of Figure 1.

Thereafter from the point **14**, the vane is turned backwards towards the outlet so that the thickness of the vane may be progressively reduced while the duct remains non-divergent as shown in Figure 8. In the embodiment illustrated, in the latter part of each duct, i. e. from the line *a—a* (Figure 8) to the outlet, the sides of the duct constituted by the vanes converge (the backwards turn being sufficient for this purpose) and the walls of the duct formed by the members **9** and **10** are maintained parallel.

The vanes are progressively rounded as shown at **15** (Figure 4), 16 (Figure 3), and 17 (Figure 2) in order that the duct which is tetragonal at the inlet and the outlet may not have sharp corners throughout the greater part of its length. This accounts for the D-shaped cross-section of the outlet shown in Figure 13 on the line *e—e* of Figure 8. One side of the outlet is constituted by a part of a vane which is some distance from the tip and is still somewhat rounded, while the other side is constituted by the tip of a vane which has there ceased to be rounded.

The radius of curvature of the part **9** should not be more than about twice the radius of curvature of the part **10**.

In order to avoid or decrease losses due to shock at the inlet the latter is preferably disposed at a little distance from the discharge outlet of the member through which the liquid has passed previously to entering the impeller and members **19** (Figures 7, 8, 15 and 16) are placed at or near the inlet in fixed relation to the vanes of the impeller. These members are of bulbous formation as shown and are shaped so as rapidly to constrict the space through which the liquid must pass before entering the inlet, i. e. from **20**, to **21**, and thereafter to provide a gradual expansion of such space up to the inlet, which must, as pointed out previously, be relatively large in order to permit a progressive reduction of cross-sectional area throughout each duct of the impeller from the inlet **4** to the outlet **5**. Although the said gradual expansion up to the inlet tends to introduce some eddying and turbulence, the total amount thereof is smaller than that which would result from shock in the absence of the members **19** and of the initial constriction caused by the bulbous ends thereof as stated above.

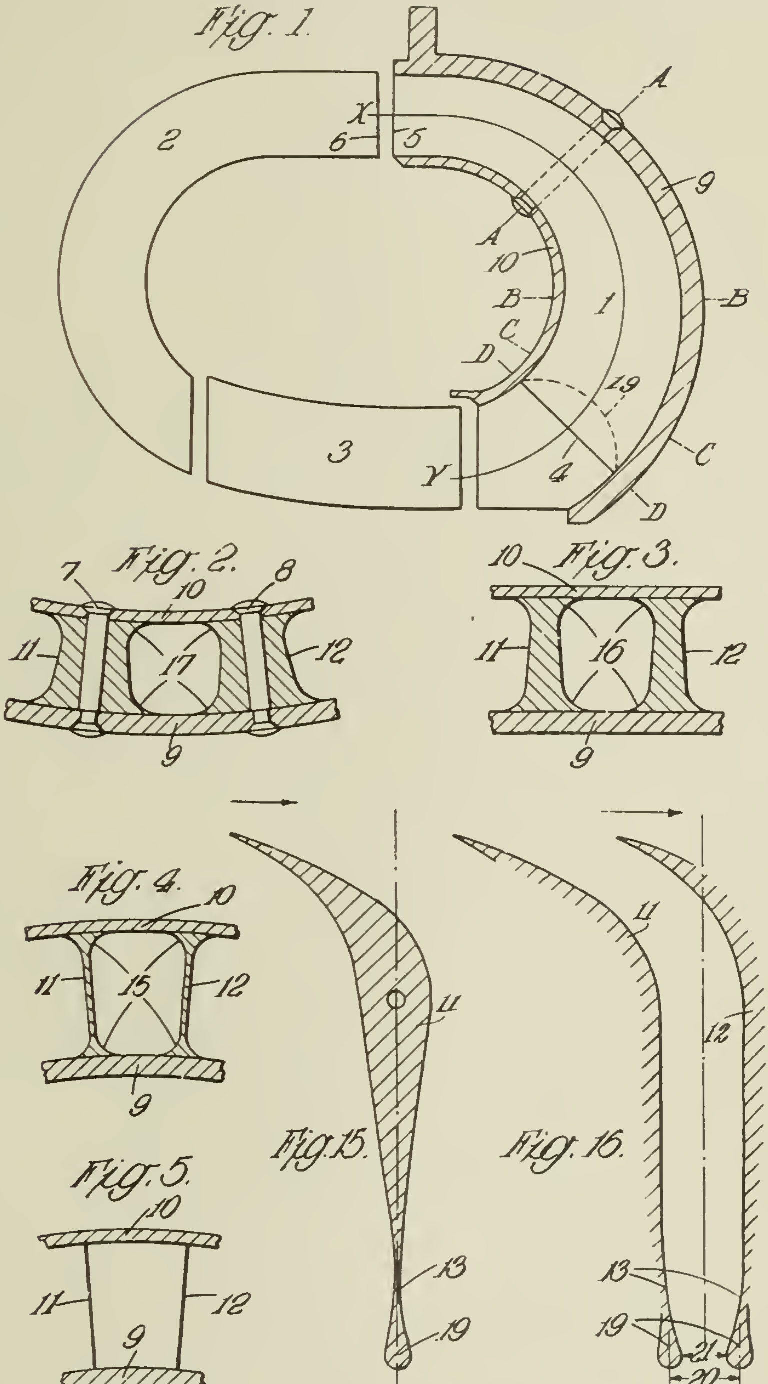
The preferred form is shown in Figures 15 and **16** where the members **19** are formed as integral extensions of the vanes, but they may be offset as shown in Figures 7 and 8.

PIERO MARIANO SALERNI.

PUBLISHED
JUNE 15, 1943.
BY A. P. C.

P. M. SALERNI
HYDRAULIC POWER TRANSMISSION APPARATUS
Filed April 8, 1939

Serial No.
266,723
2 Sheets-Sheet 1



PIERO MARIANO SALERNI INVENTOR:
BY Haseltine, Lake & Co.
ATTORNEYS

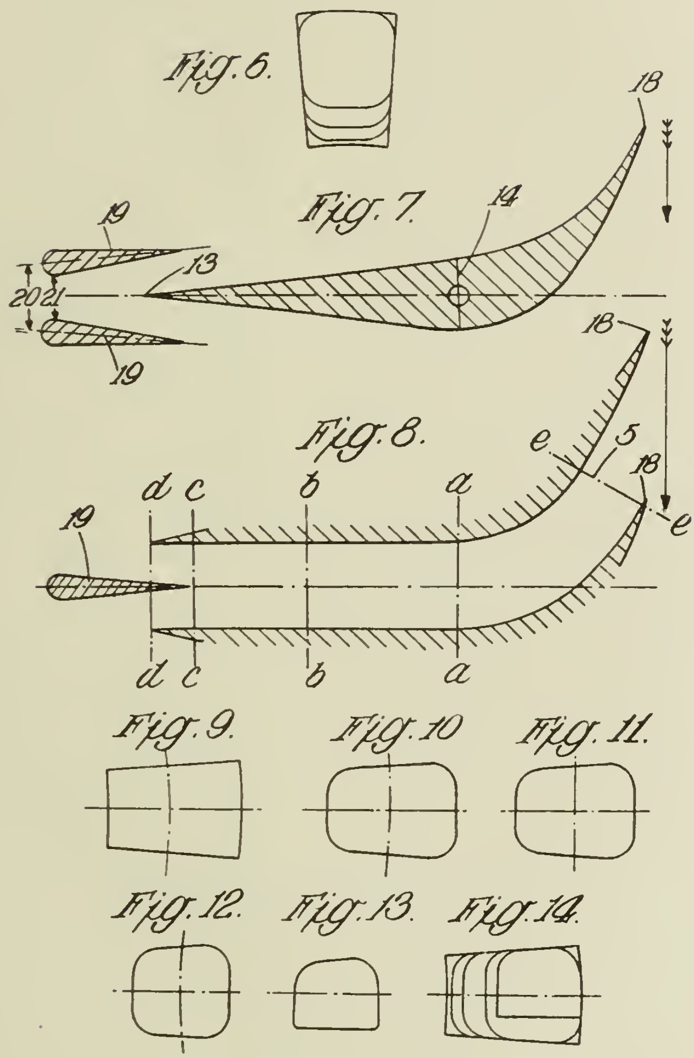
PUBLISHED
JUNE 15, 1943.
BY A. P. C.

P. M. SALERNI

HYDRAULIC POWER TRANSMISSION APPARATUS

Filed April 8, 1939

Serial No.
266,723



INVENTOR:
PIERO MARIANO SALERNI
BY: Haseltine, Lake & Co.
ATTORNEYS

Published June 15, 1943

Serial No. 270,845

ALIEN PROPERTY CUSTODIAN

EMULSIFIERS AND THE PRODUCTION OF EMULSIONS

Anders Herlöw, Grindsted, Denmark; vested in the Alien Property Custodian

No Drawing. Application filed April 29, 1939

It is well known to use for the production of emulsions of an aqueous phase in a fatty phase, for instance in a mixture of fat, a fat soluble emulsifier consisting of oxidised and/or polymerised fatty oils. The emulsions produced in this manner have the drawback that they tend to exude the aqueous phase when the emulsion is subjected to working or mechanical treatment. This is particular obvious when emulsions solid at normal temperature are produced by means of emulsifiers of said kind. Thus it is desirable, for instance in the production of margarine, to subject the emulsion, after the fat has been caused to solidify, to a subsequent treatment in the nature of kneading or rolling, but, in case the substances mentioned above have been used for the emulsifier this can scarcely be effected without partially destroying the solid or soft margarine emulsion, i. e. the finely dispersed aqueous phase will partially coalesque to form greater drops of water, the margarine being "moist" and less durable.

One object of my present invention is the provision of a method of producing emulsions of an aqueous phase in a fatty phase by means of emulsifiers and being without the drawback mentioned above. Another object is the provision of emulsifiers for this purpose and a third object of the invention are the emulsifiers themselves.

More particularly my invention has for its object the production of emulsions under which term I desire to include, here as well as in the following description and claims, also the systems called dispersions such as margarine and the like, under the employment of emulsifying substances of two kinds each of which is known. One of these kinds of emulsifiers belongs to the class of emulsifiers which are triglycerides of unsaturated fatty acids in which lipophile groups have been introduced into the fatty acid part thereof by oxydation by air or by polymerisation with other fatty acid chains having double bonds therein or by such oxidation in combination with polymerisation whereby oxygen atoms may participate in the formation of the links between the chains. The other kind of emulsifiers is esters of higher fatty acids with alcohols containing more than one alcohol group of which at least one is left unesterified. Again, it is an object of the invention to produce emulsifiers containing these kinds of emulsifying agents and adapted to produce emulsions freed from the drawback mentioned above. Still another object of my invention are these mixed emulsifiers themselves.

Further objects and purposes will appear from the following description and claims.

It is assumed that an important cause of the said drawback which has been experienced when emulsifiers consisting of oxidised and/or polymerised fatty oils are used as the only emulsifier is that the emulsifying agents within this class of emulsifiers are liquid or in some cases semiliquid, tenaceous substances. I have found that if in the film surrounding the individual drops of the aqueous phase a substance is incorporated which is solid at the temperature in question the stability of the emulsion against mechanical treatments will considerably increase. I obtain this according to my invention by adding to the emulsion and/or one or both of its components an emulsifier or emulsifiers belonging to the class of emulsifiers which are triglycerides of unsaturated fatty acids in which lipophile groups have been introduced into the fatty acid part thereof by oxidation by an oxygen containing gas or by polymerisation with other fatty acid chains having double bonds therein or by such oxidation in combination with polymerisation whereby oxygen atoms may participate in the formation of the links between the chains, as well as an emulsifier or emulsifiers which is or are an ester or esters of higher fatty acids with alcohols containing more than one hydroxy group of which at least one is left unesterified, the emulsifiers of the two kinds being added in such proportion that they would form when mixed in the same ratio outside the emulsion a mixture that will not be liquefied when heated from its solid condition to room temperature.

By this method the film surrounding the emulsified drops of the aqueous phase will obtain a degree of firmness, which will cause the emulsion to be able to endure mechanical treatment the better the higher the melting point of the mixture which is formed or would be formed by the emulsifiers added, when they were mixed outside the emulsion. This phenomenon may possibly be explained by the fact that both substances enter into the said film or take part in the formation thereof, although the film is not merely a mixture of the said substances having the melting point of the said mixture. It has been found, however, that there is a limit above which it will not be advantageous to rise the melting point which may be explained by the films surrounding the liquid drops being brittle, when the melting point of the composition is increased above a certain limit. It appears that this limit is about 60° C but it has not been exactly determined.

It has been found without importance for the result obtained whether the substances belonging to each of the two groups of emulsifiers are added simultaneously or separately and whether they are added to one or the other or both of the components of the emulsion or to the emulsion being otherwise ready. In all cases there is not formed in the emulsion a simple mixture of the components with the said emulsifiers, but the latter will both tend to gather in the interface between the oily and the aqueous phase and both will partake in the construction of the film surrounding the emulsified drops of the aqueous phase irrespectively whether one or the other of the emulsifiers has been first added.

The lowest melting point of the real or fictious mixture of the emulsifiers of the two said groups of substances at which the effect aimed at can be obtained is the lowest temperature at which the emulsion is likely or sure to be subjected to physical or mechanical influences tending to break the emulsion. Thus, in order to make an improved stability of the emulsion observable at room temperature, the emulsifier of the ester class having free hydroxy groups is added in such a proportion that the ratio of the quantity thereof to the quantity of the emulsifier of the class of the oxydised and/or polymerised fats is so that the emulsifiers will form together a mixture, which is paste-like or solid at room temperature. According to an embodiment of the invention the ratio is chosen so that the said mixture will still be paste-like or solid at the melting point of the fat to be used for or used in the emulsion, in which case the water-binding power may be observed to a greater or less degree in all treatments of the emulsions taking place when the same is solid. In case the emulsifying agents are added to a component or both components the water phase is then caused to emulsify in fat or oil by a known emulsificating treatment. In case the emulsion is produced first without the aid of said emulsifying agents the same are afterwards introduced by agitation or kneading. For the use of the invention in the production of margarine it is most advantageous to chose the ratio of the two kinds of emulsifying agents so that the melting point of the mixture will be between 20° C and 60° C. It is advantageous in many cases to add one of the kinds of emulsifiers to at least one of the components from which the emulsion is to be produced, then producing the emulsion and finally introducing the other emulsifier in the emulsion.

It has now been found that emulsions produced in the said manner with the addition of oxidised and/or polymerised fatty oils as well as esters of higher fatty acids with di-, tri- or polyvalent alcohols or derivatives thereof, in which at least one free hydroxyl group is present in the alcohol group will possess properties also in other respects which for certain important purposes are more advantageous than the properties of emulsions produced by emulsifiers of the former group alone. These properties of the emulsions produced by the new methods in a way are brought closer to the properties of emulsions produced by means of emulsifiers, which are esters of higher fatty acids with di-, tri- or polyvalent alcohols or derivates thereof, in which there is at least one free hydroxyl group in the alcoholic group. In fact the properties of an emulsion containing emulsifiers belonging to both groups are in a way mixed properties, which is advantageous, because the properties of the emulsion obtained by emulsifiers of each of the said groups are capable of complementing one another as far as those properties concern, which are advantageous in the case of the production of margarine and similar emulsions, unfavourable properties of one of the emulsifiers being more or less balanced by a corresponding favourable property of the other emulsifier.

The question is especially of such properties as for instance the tendency to burn when the emulsion is used for frying something on a pan. It is well known that margarine containing esters of the kind mentioned above with free hydroxy groups in the molecule for the emulsifier is apt to show such tendency, whereas the same tendency is not present in margarine that has been produced by means of oxidised and/or polymerised fatty oils for the emulsifier. With respect to the tendency to spatter during frying the emulsifiers of the said classes are behaving oppositely, margarine produced by means of an emulsifier consisting of oxidised or polymerised fatty oils showing this drawback, whereas the same is not to be found in the case of margarine in the production of which emulsifiers of the other said class mentioned have been used. Other examples are the capability to maintain in finely distributed state the brown frying products produced during the frying process so that said brown frying products do not flocculate nor form flakes. Still another property is the capability of taking up water with formation of a finely distributed water-in-oil emulsion, when water is added to the margarine after the same has been deprived of the water emulsified therein by frying and has been fried so long as to make the fats and dry components take a brownish shade or colour. With respect to the former property the emulsifiers of the class of oxidised or polymerised fats are preferable, whereas the emulsifiers of the ester class are deficient in this respect. With respect to the latter property the emulsifiers of the ester class are superior and the other ones are inferior.

It is moreover well known that liquid emulsions produced by mono- or diglycerides are but little stable. It has been found, however, that emulsions produced by oxidised and/or polymerised fatty oils as well as esters of higher fatty acids with di-, tri- or polyvalent alcohols in the alcohol group of which there is at least one hydroxyl group free and in which the emulsifiers of the latter class are added in the quantity stated above will possess a stability in the liquid state which is sufficient for such purposes as for instance the production of margarine.

It has moreover been found that with respect to the durability of the foam formed by the emulsion, for instance during its use for frying purposes, emulsions produced in accordance with the present invention will also possess properties which depend on the melting point of the mixture that is formed or would be formed in case the emulsifiers were present in the mixed state outside the emulsion, being the better the higher the melting point.

In view of the fact that emulsifiers of the two closses in question may be added to the emulsion or the components thereof in the form of a mixture in which the emulsifiers are incorporated in a ratio within the limits mentioned above, the invention will comprise also such mixed emulsifiers. Such emulsifiers are produced by mixing the emulsifying agents of the two kinds in such ratio that a mixture is obtained which will not

pass into liquid state until the temperature is raised above room temperature, and emulsifying agent of the class of esters having free hydroxy groups being chosen which will melt above room temperature.

According to a particularly preferable embodiment of the invention the emulsifying agents of the ester class having free hydroxy groups melt above abt. 40° C. and the mixture above abt. 30° C. The two components in the proportions securing the said final melting point the ratio being fixed by one or two experiments on the small scale, are molten together and left to cool.

By choosing suitable individuals of the two classes the hydrophilic and lipophilic properties of the two kinds of emulsifier may be varied in a way known per se, within wide limits, which alters at the same time the emulsifying, stabilising water-binding and anti-spattering effect. Thus mono glycerides are stronger water-binding than diglycerides. The mono-fatty acid-diglycerolesters, are more strongly water-binding and spattering prohibiting than mono glycerides. The same applies to other polyglycerol derivatives and to esters in which sulphuric or phosphoric acid groups are introduced. By way of example mono-stearic acid-glycose ether is pronounced spattering prohibiting. This applies also to other esters of carbohydrates. It is very good to choose for the ester having free hydroxy groups one in which the fatty acid chains are such in which hydrophilic groups are produced by oxidising by oxygen containing gases double bonds occurring therein or by interlinking by way of polymerisation such chains having double bonds therein.

The ratio between the emulsifiers of the two classes in question depends on the melting point of the emulsifier that is an ester of a higher acid with di-, tri- or polyvalent alcohols having at least one alcoholic hydroxyl group free. Using a mixture of 1 part by weight of oxydised and polymerized soya bean oil and two parts by weight of soya bean oil monoglyceride a substance will be obtained which is liquid at room temperature. Using mono-glyceride of fully hardened arachide oil the melting point being about 60° C. a substance will be obtained which is solid at room temperature even when the amount of the mono-glyceride be reduced to half the amount of oxydised or polymerised oil.

To illustrate the connection between consistency and melting point and the various mixtures of emulsifiers some examples are mentioned in the following showing mixtures of fatty acid glycerine esters of various melting point with soya bean oil, which is oxydised and polymerised by blowing with air at 250° C. until a degree of oxidation and polymerisation has been obtained at which the oil will be liquid only at about 100° C., but without the oxidation and polymerisation having been carried so far that the oil has gelatinized.

Fatty acid glycerine ester		Oxyd. and polym. soya bean oil, ratio	The mixture	
Kind and M. P.	Ratio	Ratio	M. P.	Relative[1] consistency 15° C.
Monoglyceride M. P. abt. 60° C.	200	100	55	17
	100	100	55	9
	100	200	53	1
Monoglyceride M. P. 40° C.	200	100	40	4
	100	100	40	2
	100	200	Abt. 35	0, 5
Mono fatty acid-polyglycerine M. P. 55° C.	200	100	Abt. 54	Abt. 5, 0
	100	100	Abt. 54	Abt. 2, 5

[1] States the reciprocal value of the volume (in ccm) of the impression produced by a sphere of 20 mm diameter weighted by 5.5 kgs.

ANDERS HERLÓW.

ALIEN PROPERTY CUSTODIAN

METHODS AND DEVICES FOR SHAPING PIECES

Félix Amiot, Neuilly-sur-Seine, France; vested in the Alien Property Custodian

Application filed May 6, 1939

The present invention relates to methods and devices for shaping pieces, especially metal pieces by causing them to conform to shaping members or suitable curved pieces.

The chief object of the present invention is to provide a method and device of the type above referred to which is capable of meeting the requirements of practice, especially concerning the finish of the articles obtained and the rapidity of work.

The essential feature of the present invention consists in subjecting the pieces to be treated, in the course of their shaping, to a given tension or stretching, preferably close to their elastic limit.

According to another feature of the present invention, when it is desired to conform a surface to the shape of another surface, for instance to conform a sectional iron to be bent to a shaping piece, I guide the piece to be bent by means of a carriage or another analogous system capable of moving along a path such, and of exerting between said piece and these guiding means forces such, that said carriage automatically tends, under the effect of these forces, to move in the direction which corresponds to the bending of the piece.

Other features of the present invention will result from the following detailed description of some specific embodiments thereof.

Preferred embodiments of the present invention will be hereinafter described, with reference to the accompanying drawings, given merely by way of example.

Fig. 1 is an elevational view of a machine for bending sectional irons in accordance with the method of the invention, this machine itself being made according to the invention;

Fig. 2 is a sectional view on an enlarged scale on the line II—II of Fig. 1;

Fig. 3 is a partial diagrammatic back view corresponding to Figs. 1 and 2.

In the following description with reference to the drawings, it will be supposed that the invention is applied to the bending and shaping of sheet iron pieces intended, for instance, for use in aeronautical construction.

It is already known, for shaping such pieces, to start from elements or irons of suitable section, either rectilinear or already curved, which are adapted in any suitable manner on shaping elements.

One of the difficulties that are met with is to ensure a perfect contact of the metal at all points with the shaping element. As a matter of fact, some portions of the piece to be treated tend to form undulations or folds.

In order to obviate these drawbacks, and also to obtain further advantages which will appear hereinafter, I proceed in such manner, according to the present invention, that the pieces are subjected, in the course of their shaping, to a suitable tension or stretching, which may be, but is not necessarily, close to the elastic limit of the metal of which said pieces are made.

According to the present invention, this tension may be applied in a single operation during the whole time of the shaping operation, while the piece is being brought into contact with the surfaces of the bent element, or this tension may be applied only during a portion of this operation, especially at the end thereof, after the piece to be treated has already been brought into contact with the bent element and there remains only to perfect the bending of said piece.

Or, according to a preferred embodiment of the invention, the tension or stretching is applied in several successive steps, and this, if need be, in correspondence with different values of the tension; for instance the method includes the utilization of relatively low tension f during the period of time for which the piece is brought into contact with the shaping element, then, after this contact has been established, the piece is subjected to a higher tension F (which is for instance, in the case above considered, close to the elastic limit, while the first value f averages F/10 or more).

Of course, the tension or stretching may be applied in a different manner.

Concerning now the apparatus to be provided for carrying out the method above specified, it can be devised in many different ways.

However, it seems advantageous to have recourse, for the construction of this apparatus, to another feature of the invention according to which, in order to cause the piece to be treated to conform to the shape of the curved element, use is made of the tension applied to said piece, this tension serving, in combination with suitable guiding means, automatically to produce the desired displacements or deformations.

Supposing, for instance, that it is desired to bend a sectional iron **1** to the shape of a curvilinear element **2**, for example with a view to obtaining a rib element for an airplane wing, said sectional iron having, in particular, in the known manner, a U-shaped section with a groove **3** along which it can be sawed into two parts, and shaping member **2** having inner shaping surfaces **4** which

correspond to those of said sectional iron, I proceed as follows:

Concerning first the means for exerting the desired tension or stretching on the sectional iron, I preferably make use of pneumatic or hydraulic means. In particular, if a certain pneumatic pressure is available, it is advantageous, especially if two elementary operations are to take place at tensions *f* and F, to have this pressure acting on hydropneumatic relays, in such manner as to have, at will, either of two hydraulic pressures *p* and P, it being understood that it is possible to act on the pneumatic pressure through pressure relieving means.

The hydraulic or other pressure that is obtained is then caused to act:

a. either only at one of the ends of the sectional iron, the other end of said piece being secured in any suitable manner; or

b. at least during the second step of the process, at both ends in such manner as to obtain, by balancing the frictional stresses on the curved element, a suitable balancing of the tensions over the whole length of the piece.

In the embodiment of Fig. 1, I have shown two receivers, for instance of the hydraulic type, **5** and **6**, which receive fluid under pressure through flexible conduits **7** and **8** and are connected to the sectional iron through jaws **9** of any suitable type holding the ends of said sectional iron **1**.

Concerning now the means for bringing the sectional iron into intimate contact with the corresponding shaping piece, through the application of the pressure, they are, for instance, advantageously made as follows:

One of the receivers, **5** for instance, is pivotally secured at **10** to the frame **11** of the machine;

The other receiver is carried by a carriage **12** capable of moving along a guiding path element **13** arranged in such manner that the application the pressure tends to cause said carriage to move forward along said path in the desired direction. In order to obtain this result, the tangent to the guiding path should make, with the direction of the effort exerted by the pressure, an angle different from 90°, which angle will be calculated in a suitable manner as a function of said pressure (this obliquity corresponding, for instance, to a gradient of, say 10%).

The guiding rail **13** is, for instance, carried, by a support **14** which may also carry means for controlling the pressure such as **15**, a pressure gauge **16**, and so on.

Advantageously, I further provide means for conjugating the displacements or deformations of the piece to be bent with the control of the pressure, in such manner that the passage from pressure *p* to pressure P can take place only when the piece comes into its bent position on shaping element **2**.

For this purpose, for instance, carriage **12** can come, at the end of its movement, into engagement with a locking member **17**. Said member coacts with the end **20** of a finger **21** carried by the operating wheel **15** of the machine. Normally, locking member **20**, in cooperation with **17**, prevents wheel **15** from being turned in the direction of arrow *f*. When the carriage passes (position shown in dotted lines in Fig. 1) locking member **17** is moved away, and the operating wheel **15** can be turned. I might provide any other equivalent means and, in particular, member **17** might be adapted automatically to produce the shifting from pressure *p* to pressure P.

In Fig. 3, I have shown, by way of example, several means for the control of the pressure applied by the apparatus.

The hydropneumatic relays are shown at **22** (low pressure) and **23** (high pressure). They are supposed to be electrically controlled, through electro-valves **24**, **25**. In one position, these electro-valves, admit into the corresponding cylinder the air from the compressed air main conduit **26** and, in the other position, they connect said cylinder with the exhaust, it being well understood that, instead of this electric control, I might provide any other type of control, for instance a pneumatic control.

The operating wheel, such as **15** (Fig. 1) is adapted simultaneously to control:

a. On the one hand, a three way cock **27** (Fig. 3) which permits, in a first position, of connecting cylinder **6** to the high pressure relay, and, in a second position, to connect both of the cylinders **5** and **6** to the high pressure relay; and,

b. On the other hand, a contactor **28** (Figs. 1 and 3) adapted to bring into play first electro-valve **24** and then electro-valve **25**.

I thus obtain a system which works in the following manner:

At the beginning of a shaping operation, the sectional iron occupies a position such as shown in solid lines by Fig. 1. The relays are then supposed to be in communication with the atmosphere, which corresponds to the zero position (Fig. 1) of wheel **15**.

This wheel **15** is then operated in direction *f* until it comes into position **1**, illustrated by Fig. 1, for which the low pressure is introduced into receiving element **6**, for instance through the action of valve **24** and cock **27**. The component of this pressure in the direction of the rolling track **13** immediately produces the displacement of carriage **12**. Sectional iron **1** is caused to conform to the shape of piece **2**. The reaction at the other end, at **5**, is supposed to be supported, in the embodiment illustrated by the drawing, by the frame of the machine, due to the fact that the jaw **9** on the left hand side is applied against the shaping member **2**, or the frame **11**.

When carriage **12** comes near to the end of its movement, it acts upon locking member **17**. Consequently, finger **21** is unlocked, so that the operator can actuate wheel **15** so as to bring it into position **2**, which causes the high pressure to be admitted to both of the receiving cylinders **5** and **6**.

Finally, when it is found that the deformations of the piece have become definitive, the hand wheel **15** is brought back to the zero position, which stops the action of the pressure.

It is then possible to remove the finished piece.

Means, such as a winch **18** and a cable **19**, may be provided for bringing back carriage **12** to its initial position. Furthermore, a compressed air conduit **30** (Fig. 3), provided with a cock **31**, may also be provided for bringing back the pistons of the receiving cylinders to their initial positions, by discharging the liquid toward relays **22**, **23**.

On the other hand, it should be noted that, in order to avoid the risk of the lips of the sectional iron being moved toward each other, during the stretching operation, I may place between them small spacing members **29** (Fig. 2).

Also, it should be noted that a same carriage **12** and a same receiving system **5**, **6** might coact with a plurality of sectional irons and shaping elements.

These shaping elements 2 might further be made deformable at will in such manner as to permit shapings of all kinds. Likewise, supporting member 14 might be made adjustable.

In any case, it will be readily understood that the method according to the invention has, over existing methods of the same kind, many advantages, and, in particular, the following:

The pieces are obtained without defects, and especially without folds, which are avoided by the stretching of the metal.

It is possible to apply the method to all kinds of pieces (for instance, in aeronautical construction, to sectional irons for making elements of the fuselage, of the wings, and so on).

The operation is quickly effected, since the shaping takes place under the sole action of the tension.

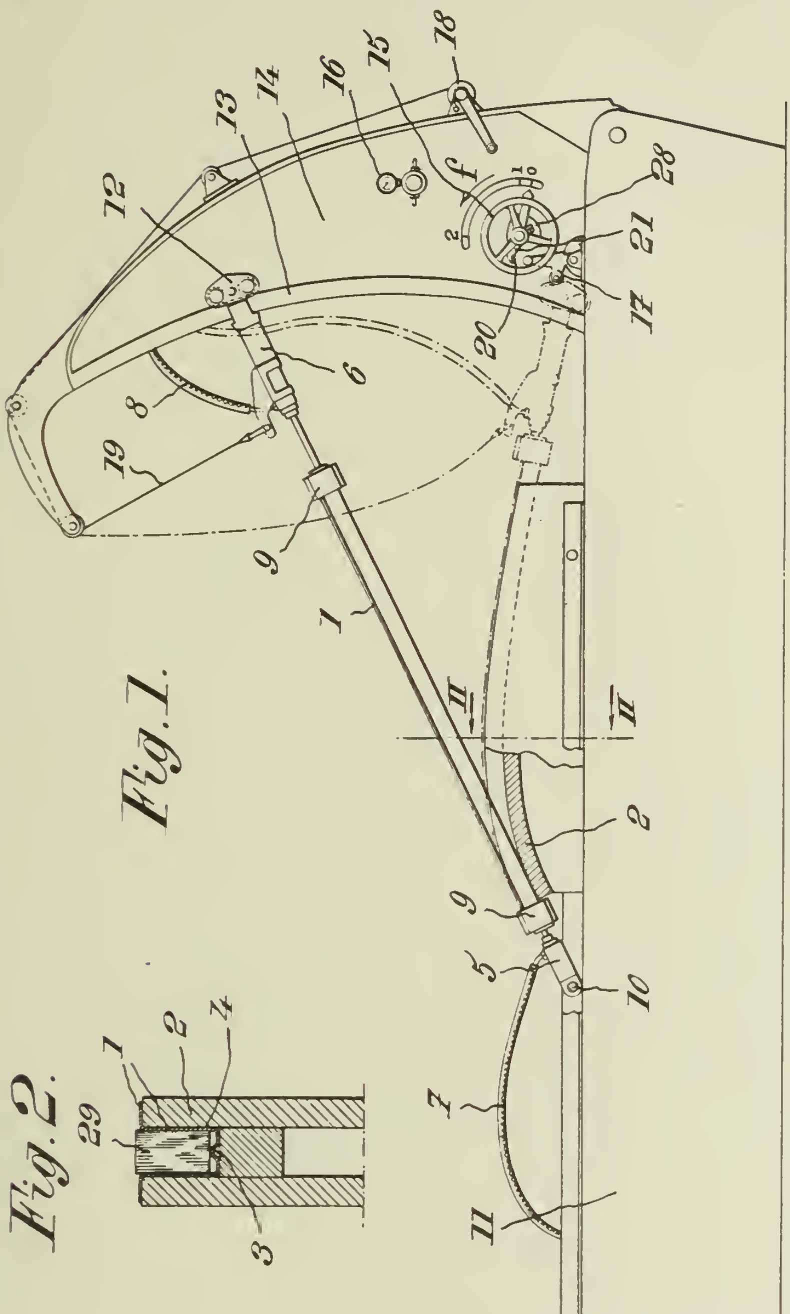
Of course, before and after the shaping, the pieces may be subjected to all suitable thermic operations.

FÉLIX AMIOT.

PUBLISHED
JUNE 15, 1943.
BY A. P. C.

F. AMIOT
METHODS AND DEVICES FOR SHAPING PIECES
Filed May 6, 1939

Serial No.
272,281
2 Sheets-Sheet 1



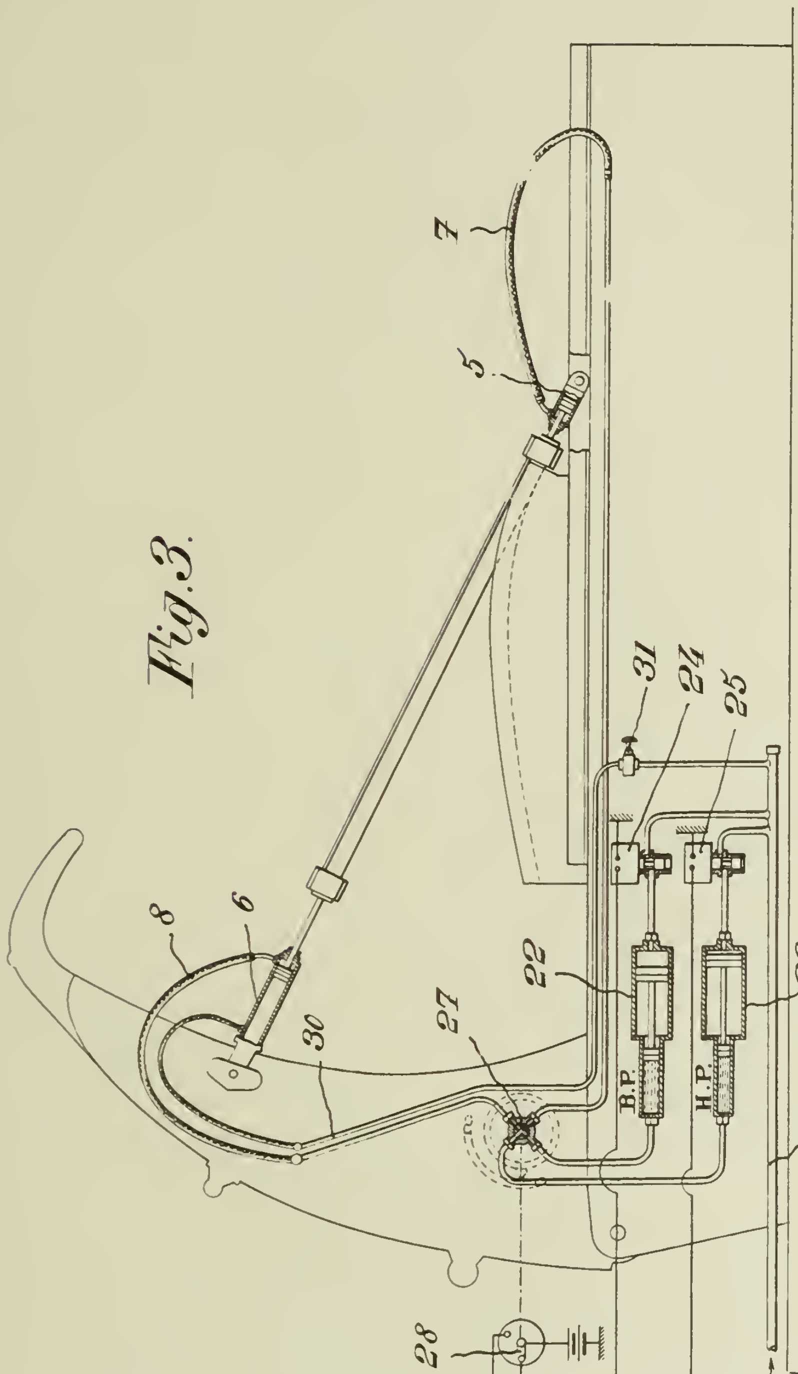
Inventor:
Félix Amiot,

Bailey & Larson
Attorneys

PUBLISHED
JUNE 15, 1943.
BY A. P. C.

F. AMIOT
METHODS AND DEVICES FOR SHAPING PIECES
Filed May 6, 1939

Serial No.
272,281
2 Sheets-Sheet 2



Inventor:
Félix Amiot,

Attorneys

Published June 15, 1943 Serial No. 270,845

ALIEN PROPERTY CUSTODIAN

EMULSIFIERS AND THE PRODUCTION OF EMULSIONS

Anders Herlöw, Grindsted, Denmark; vested in the Alien Property Custodian

No Drawing. Application filed April 29, 1939

It is well known to use for the production of emulsions of an aqueous phase in a fatty phase, for instance in a mixture of fat, a fat soluble emulsifier consisting of oxidised and/or polymerised fatty oils. The emulsions produced in this manner have the drawback that they tend to exude the aqueous phase when the emulsion is subjected to working or mechanical treatment. This is particular obvious when emulsions solid at normal temperature are produced by means of emulsifiers of said kind. Thus it is desirable, for instance in the production of margarine, to subject the emulsion, after the fat has been caused to solidify, to a subsequent treatment in the nature of kneading or rolling, but, in case the substances mentioned above have been used for the emulsifier this can scarcely be effected without partially destroying the solid or soft margarine emulsion, i. e. the finely dispersed aqueous phase will partially coalesque to form greater drops of water, the margarine being "moist" and less durable.

One object of my present invention is the provision of a method of producing emulsions of an aqueous phase in a fatty phase by means of emulsifiers and being without the drawback mentioned above. Another object is the provision of emulsifiers for this purpose and a third object of the invention are the emulsifiers themselves.

More particularly my invention has for its object the production of emulsions under which term I desire to include, here as well as in the following description and claims, also the systems called dispersions such as margarine and the like, under the employment of emulsifying substances of two kinds each of which is known. One of these kinds of emulsifiers belongs to the class of emulsifiers which are triglycerides of unsaturated fatty acids in which lipophile groups have been introduced into the fatty acid part thereof by oxydation by air or by polymerisation with other fatty acid chains having double bonds therein or by such oxidation in combination with polymerisation whereby oxygen atoms may participate in the formation of the links between the chains. The other kind of emulsifiers is esters of higher fatty acids with alcohols containing more than one alcohol group of which at least one is left unesterified. Again, it is an object of the invention to produce emulsifiers containing these kinds of emulsifying agents and adapted to produce emulsions freed from the drawback mentioned above. Still another object of my invention are these mixed emulsifiers themselves.

Further objects and purposes will appear from the following description and claims.

It is assumed that an important cause of the said drawback which has been experienced when emulsifiers consisting of oxidised and/or polymerised fatty oils are used as the only emulsifier is that the emulsifying agents within this class of emulsifiers are liquid or in some cases semiliquid, tenaceous substances. I have found that if in the film surrounding the individual drops of the aqueous phase a substance is incorporated which is solid at the temperature in question the stability of the emulsion against mechanical treatments will considerably increase. I obtain this according to my invention by adding to the emulsion and/or one or both of its components an emulsifier or emulsifiers belonging to the class of emulsifiers which are triglycerides of unsaturated fatty acids in which lipophile groups have been introduced into the fatty acid part thereof by oxidation by an oxygen containing gas or by polymerisation with other fatty acid chains having double bonds therein or by such oxidation in combination with polymerisation whereby oxygen atoms may participate in the formation of the links between the chains, as well as an emulsifier or emulsifiers which is or are an ester or esters of higher fatty acids with alcohols containing more than one hydroxy group of which at least one is left unesterified, the emulsifiers of the two kinds being added in such proportion that they would form when mixed in the same ratio outside the emulsion a mixture that will not be liquefied when heated from its solid condition to room temperature.

By this method the film surrounding the emulsified drops of the aqueous phase will obtain a degree of firmness, which will cause the emulsion to be able to endure mechanical treatment the better the higher the melting point of the mixture which is formed or would be formed by the emulsifiers added, when they were mixed outside the emulsion. This phenomenon may possibly be explained by the fact that both substances enter into the said film or take part in the formation thereof, although the film is not merely a mixture of the said substances having the melting point of the said mixture. It has been found, however, that there is a limit above which it will not be advantageous to rise the melting point which may be explained by the films surrounding the liquid drops being brittle, when the melting point of the composition is increased above a certain limit. It appears that this limit is about 60° C but it has not been exactly determined.

It has been found without importance for the result obtained whether the substances belonging to each of the two groups of emulsifiers are added simultaneously or separately and whether they are added to one or the other or both of the components of the emulsion or to the emulsion being otherwise ready. In all cases there is not formed in the emulsion a simple mixture of the components with the said emulsifiers, but the latter will both tend to gather in the interface between the oily and the aqueous phase and both will partake in the construction of the film surrounding the emulsified drops of the aqueous phase irrespectively whether one or the other of the emulsifiers has been first added.

The lowest melting point of the real or fictious mixture of the emulsifiers of the two said groups of substances at which the effect aimed at can be obtained is the lowest temperature at which the emulsion is likely or sure to be subjected to physical or mechanical influences tending to break the emulsion. Thus, in order to make an improved stability of the emulsion observable at room temperature, the emulsifier of the ester class having free hydroxy groups is added in such a proportion that the ratio of the quantity thereof to the quantity of the emulsifier of the class of the oxydised and/or polymerised fats is so that the emulsifiers will form together a mixture, which is paste-like or solid at room temperature. According to an embodiment of the invention the ratio is chosen so that the said mixture will still be paste-like or solid at the melting point of the fat to be used for or used in the emulsion, in which case the water-binding power may be observed to a greater or less degree in all treatments of the emulsions taking place when the same is solid. In case the emulsifying agents are added to a component or both components the water phase is then caused to emulsify in fat or oil by a known emulsificating treatment. In case the emulsion is produced first without the aid of said emulsifying agents the same are afterwards introduced by agitation or kneading. For the use of the invention in the production of margarine it is most advantageous to chose the ratio of the two kinds of emulsifying agents so that the melting point of the mixture will be between 20° C and 60° C. It is advantageous in many cases to add one of the kinds of emulsifiers to at least one of the components from which the emulsion is to be produced, then producing the emulsion and finally introducing the other emulsifier in the emulsion.

It has now been found that emulsions produced in the said manner with the addition of oxidised and/or polymerised fatty oils as well as esters of higher fatty acids with di-, tri- or polyvalent alcohols or derivatives thereof, in which at least one free hydroxyl group is present in the alcohol group will possess properties also in other respects which for certain important purposes are more advantageous than the properties of emulsions produced by emulsifiers of the former group alone. These properties of the emulsions produced by the new methods in a way are brought closer to the properties of emulsions produced by means of emulsifiers, which are esters of higher fatty acids with di-, tri- or polyvalent alcohols or derivates thereof, in which there is at least one free hydroxyl group in the alcoholic group. In fact the properties of an emulsion containing emulsifiers belonging to both groups are in a way mixed properties, which is advantageous, because the properties of the emulsion obtained by emulsifiers of each of the said groups are capable of complementing one another as far as those properties concern, which are advantageous in the case of the production of margarine and similar emulsions, unfavourable properties of one of the emulsifiers being more or less balanced by a corresponding favourable property of the other emulsifier.

The question is especially of such properties as for instance the tendency to burn when the emulsion is used for frying something on a pan. It is well known that margarine containing esters of the kind mentioned above with free hydroxy groups in the molecule for the emulsifier is apt to show such tendency, whereas the same tendency is not present in margarine that has been produced by means of oxidised and/or polymerised fatty oils for the emulsifier. With respect to the tendency to spatter during frying the emulsifiers of the said classes are behaving oppositely, margarine produced by means of an emulsifier consisting of oxidised or polymerised fatty oils showing this drawback, whereas the same is not to be found in the case of margarine in the production of which emulsifiers of the other said class mentioned have been used. Other examples are the capability to maintain in finely distributed state the brown frying products produced during the frying process so that said brown frying products do not flocculate nor form flakes. Still another property is the capability of taking up water with formation of a finely distributed water-in-oil emulsion, when water is added to the margarine after the same has been deprived of the water emulsified therein by frying and has been fried so long as to make the fats and dry components take a brownish shade or colour. With respect to the former property the emulsifiers of the class of oxidised or polymerised fats are preferable, whereas the emulsifiers of the ester class are deficient in this respect. With respect to the latter property the emulsifiers of the ester class are superior and the other ones are inferior.

It is moreover well known that liquid emulsions produced by mono- or diglycerides are but little stable. It has been found, however, that emulsions produced by oxidised and/or polymerised fatty oils as well as esters of higher fatty acids with di-, tri- or polyvalent alcohols in the alcohol group of which there is at least one hydroxyl group free and in which the emulsifiers of the latter class are added in the quantity stated above will possess a stability in the liquid state which is sufficient for such purposes as for instance the production of margarine.

It has moreover been found that with respect to the durability of the foam formed by the emulsion, for instance during its use for frying purposes, emulsions produced in accordance with the present invention will also possess properties which depend on the melting point of the mixture that is formed or would be formed in case the emulsifiers were present in the mixed state outside the emulsion, being the better the higher the melting point.

In view of the fact that emulsifiers of the two closses in question may be added to the emulsion or the components thereof in the form of a mixture in which the emulsifiers are incorporated in a ratio within the limits mentioned above, the invention will comprise also such mixed emulsifiers. Such emulsifiers are produced by mixing the emulsifying agents of the two kinds in such ratio that a mixture is obtained which will not

pass into liquid state until the temperature is raised above room temperature, and emulsifying agent of the class of esters having free hydroxy groups being chosen which will melt above room temperature.

According to a particularly preferable embodiment of the invention the emulsifying agents of the ester class having free hydroxy groups melt above abt. 40° C. and the mixture above abt. 30° C. The two components in the proportions securing the said final melting point the ratio being fixed by one or two experiments on the small scale, are molten together and left to cool.

By choosing suitable individuals of the two classes the hydrophilic and lipophilic properties of the two kinds of emulsifier may be varied in a way known per se, within wide limits, which alters at the same time the emulsifying, stabilising water-binding and anti-spattering effect. Thus mono glycerides are stronger water-binding than diglycerides. The mono-fatty acid-diglycerolesters, are more strongly water-binding and spattering prohibiting than mono glycerides. The same applies to other polyglycerol derivatives and to esters in which sulphuric or phosphoric acid groups are introduced. By way of example mono-stearic acid-glycose ether is pronounced spattering prohibiting. This applies also to other esters of carbohydrates. It is very good to choose for the ester having free hydroxy groups one in which the fatty acid chains are such in which hydrophilic groups are produced by oxidising by oxygen containing gases double bonds occurring therein or by interlinking by way of polymerisation such chains having double bonds therein.

The ratio between the emulsifiers of the two classes in question depends on the melting point of the emulsifier that is an ester of a higher acid with di-, tri- or polyvalent alcohols having at least one alcoholic hydroxyl group free. Using a mixture of 1 part by weight of oxydised and polymerized soya bean oil and two parts by weight of soya bean oil monoglyceride a substance will be obtained which is liquid at room temperature. Using mono-glyceride of fully hardened arachide oil the melting point being about 60° C. a substance will be obtained which is solid at room temperature even when the amount of the mono-glyceride be reduced to half the amount of oxydised or polymerised oil.

To illustrate the connection between consistency and melting point and the various mixtures of emulsifiers some examples are mentioned in the following showing mixtures of fatty acid glycerine esters of various melting point with soya bean oil. which is oxydised and polymerised by blowing with air at 250° C. until a degree of oxidation and polymerisation has been obtained at which the oil will be liquid only at about 100° C., but without the oxidation and polymerisation having been carried so far that the oil has gelatinized.

Fatty acid glycerine ester		Oxyd. and polym. soya bean oil, ratio	The mixture	
Kind and M. P.	Ratio	Ratio	M. P.	Relative [1] consistency 15° C.
Monoglyceride M. P. abt. 60° C.	200	100	55	17
	100	100	55	9
	100	200	53	1
Monoglyceride M. P. 40° C.	200	100	40	4
	100	100	40	2
	100	200	Abt. 35	0, 5
Mono fatty acid-polyglycerine M. P. 55° C.	200	100	Abt. 54	Abt. 5, 0
	100	100	Abt. 54	Abt. 2, 5

[1] States the reciprocal value of the volume (in ccm) of the impression produced by a sphere of 20 mm diameter weighted by 5.5 kgs.

ANDERS HERLÓW.

Published June 15, 1943 Serial No. 278,941

ALIEN PROPERTY CUSTODIAN

DEVICE FOR THE SPEED REGULATION OF ELECTRIC COMMUTATOR MACHINES

Placido Flury, Novara, Italy; vested in the Alien Property Custodian

Application filed June 13, 1939

The present invention relates to the speed regulation of electric commutator machines, and more particularly speed regulation systems, where the speed and direction of rotation of the driven shaft may be controlled at pleasure, independently of the load or the number of revolutions of the driving motor.

The possibility of the speed regulation of electric commutator machines by means of brush displacement is known. If it is question about shunt-machines, a definite brush position corresponds with a definite speed, this latter remaining constant at variable load. If, however, they have series characteristics, the speed varies with the load variation, excepted the continuous regulation by means of brush displacement.

The idea of this invention is to regulate the speed of the commutator machine through the speed of an auxiliary device, which may be defined by "pilot device." The brush displacement (or more general, the position of the rotor field in relation to the stator field or vice-versa) is self-regulated by the difference between the angular velocities of the commutator machine and the pilot axle. The shaft of the commutator machine, called driving shaft, follows the movements of the pilot device in a synchronous way. If the said device is used for commutator series or shunt-machines, they change their speed characteristics. The motor speed is regulated when regulating the speed of the pilot axle. As the only mechanical work required from the pilot axle is to overcome the friction between brushes and commutator, it may easily be substituted by a small motor. The regulation of this latter is generally not very difficult, as it is not question about its efficiency, in view of the small power requested.

The selfregulated commutator machines with the device being object of this invention work always with best efficiency and power factor, even with partial loads. Using, for instance, the device for a machine with series characteristics, there are the remarkable advantages of a strong starting torque with smallest charging rate, without perceiving the known disadvantages deriving from the inconstancy of the speed in relation to the load.

Devices are known, as for instance electrical joints or speed reducers, which are placed upon the driving shaft of motors, the speed of which can vary conveniently only within rather reduced limits, and which cannot start in load condition, as for instance explosion motors used for traction, and where a variable speed control and a full load starting are required. There are devices that contain in themselves the gifts of generator and motor. Using for these devices the commutator as regulating organ, actuated as described in this invention, the speed and direction of rotation of the driven shaft may be controlled at pleasure, as if it were question about an electric motor, and that independently of the load or the number of revolutions of the driving motor.

The invention finds therefore full application in cases of variable load or speed, in cases where both vary, as well as also in cases, where a well constant or a well definite speed is required, or also in cases where the speed should vary in a well definite way, as it is the case with paper-machines, rolling-mills, all kinds of mills, textile machines, machine tools, transporting and lifting devices, elevators, etc.

There are further an infinity of hand-operated driving devices in use, which require sometimes such a stress that would not be superable, if not through auxiliary gearings and motors. The object of this invention is especially adapted for all applications of kind. All the movements effected upon the pilot device with smallest stress are rigourously reproduced by the driving shaft, but with a whatever higher stress ratio than that used, and so as to overcome easily the stress required.

The ways of practical execution are various; four of them are fundamental, as the regulating member may be applied upon the stationary part (stator) or upon the rotating part of the machine (rotor), and the regulation may be effected by means of the angular displacement of the brushes or of the commutator. The operation is explained with some examples of practical application.

Fig. 1 shows the application of the invention at a series three-phase commutator machine. The regulation is done by means of displacement of the commutator, which is loose on the rotor shaft, whilst the brushes are fixed. An example of a pilot device is an induction motor having two sets of different number of poles, provided with a centrifugal brake, so as to obtain a further speed graduation.

Fig. 2 shows said application at a series three-phase commutator machine. The commutation structure is mechanically separated from the main machine. The pilot device is represented by a three-phase induction motor. The commutator is provided loose upon the pilot shaft, whilst the brushes are fixed.

Fig. 3 shows the construction of a damping device to be arranged upon the rotatable part, as shown in the case of Fig. 1.

Fig. 4 shows the arrangement of the flexible conductors in case of a commutator with angular displacement in relation to the rotor, as in the example of Fig. 1.

Fig. 5 shows the arrangement of the flexible conductors in case of angular displacement of the brushes, arranged upon the stationary part of the commutator machine.

Referring to Fig. 1, its lower part shows a series commutator machine of normal and known construction, of which 101 is the stator and 102 the rotor. The only variation is, that the commutator 103 is loose upon the axle 104, instead of being united with the rotor 102, and is driven by the pilot motor 105 by means of the belt or chain 106 and the pulleys 107 and 108, or by means of other transmission systems. The connections between the angularly movable commutator 103 and the rotor winding 102 are realized by means of flexible conductors 109, or by means of sliding contacts. The brushes X_1—Y_1—Z_1, however, are stationary. The regulation is obtained through the difference between the angular speed of the commutator 103 and that of the rotor 102 of the machine, the commutator 103 being loose upon the rotor shaft 104. Therefore an angular displacement of the commutator 103 in relation to the rotor 102 results, instead of the angular displacement of the brushes X_1—Y_1—Z_1 in relation to the stator 101, this latter being a generally known and used system.

Further, whilst in this latter case of known application the torque and the speed increase by displacing the brushes X_1—Y_1—Z_1 in relation to the stator 101 in the opposite sense to the running sense, the torque and the speed increase in the example of Fig. 1 with the angular displacement of the commutator 103 in relation to the rotor 102 in the same running sense.

The machine is fed through the terminals U—V—W, which are the terminals of the stator-winding 101, whilst the other winding terminals X—Y—Z are connected with the brushes X_1—Y_1—Z_1, by interposition of the transformer 110 for the reduction of the commutation tension.

The regulation device works as follows: Displacing the commutator 103, which has to be in neutral position, by means of the pilot motor 105, the torque of the rotor 102 increases with the increasing of the displacing angle, up to overcome the load. In this moment the rotor 102 begins to rotate and starts. It follows the commutator 103, and the acceleration is maintained, until the moment at which the angle of displacement is decreased, so as to attain the equilibrium between the motor torque and the load. In case of an increase of the load, the rotor 102 remains retarded in relation to the commutator 103, causing the increase of the angle of displacement, and in consequence the motor torque increases, up to overcome the greater load. In case of a decrease of the load, the rotor 102 advances the commutator 103, causing the decrease of the angle of displacement, and in consequence the motor torque decreases, as far as to find again the equilibrium. Increasing the speed of the commutator 103 in relation to the rotor 102, the angle of displacement is increased and therefore also the motor torque, enabling the rotor 102 to increase its speed, as far as to arise to that of the commutator 103. Decreasing the speed of the commutator 103, the rotor 102 advances the commutator, causing the decreasing of the angle of displacement, and in consequence the motor torque decreases, as far as to decrease the speed of the rotor 102, making it equal to that of the commutator 103. The rotor 102 follows therefore continuously all the movements of the commutator 103 in a synchronous way, that is to say all the movements of the pilot motor 105, and that independently of the load. The commutator 103 and the rotor 102 can vary their relative position only within the limits of the angle of displacement of these two members to each other. This angle is less than ±180° electric in case of a series connected motor; practically there is regulated within about ±150° electric from the neutral position.

In order to avoid hunting of the rotor 102 in relation to the commutator 103, as this is easily the case in all synchronous machines, a damper is arranged between the two members. It comprises a cylindrical hollow body 111, which is adjusted upon the pilot axle 112, and a fly-wheel 113 arranged very closely spaced into said cylinder, which is filled with a damping liquid generating there a hydraulic friction. The movement of the rotor 102 or of the driving axle 104 is transmitted to the inner body 113 of the damper by means of the belt or chain 114 and the wheels 115 and 116, or by means of other transmission systems.

To avoid that in case of excessive overload the displacement of the rotor 102 in relation to the commutator 103 has to overpass the normal limits of ±150° electric, stopping members or the like, preferably resilient ones, are used.

In the case of Fig. 1, three different speeds of the pilot axle 112 are provided, and therefore three are also three speeds for the commutator machine. Two speeds are obtained by means of the commutation of the two windings U_1—V_1—W_1 or U_2—V_2—W_2 of the pilot motor 105 with different number of poles, and a third speed by means of a centrifugal brake 117 of normal and known construction, which is operated by the electromagnet 118, and is fed through the terminals R—S.

In Fig. 1 the pilot motor 105 is placed near the main motor 101 and connected with this latter by means of two belts 106 and 114, chains, gears or the like, of which the one drives the commutator, whilst the other one transmits the movement of the driving axle to the damper. However, different arrangements are possible, as for instance that of the pilot motor coaxial with the main motor, and so on.

A second fundamental arrangement provides a known commutator machine with fixed commutator upon the rotor and movable brush yoke ring. The rotor of the pilot motor is coupled directly, or by means of a transmission system, with the rotor of the main machine, whilst its stator is coupled in an analogue way with the brush yoke ring. The stator of the pilot motor is therefore arranged such as to effect easily an angular displacement similar to that of the brush yoke ring. The feeding of the pilot motor has necessarily to be effected by means of flexible conductors or by means of sliding contacts. The operation is similar to that precedently described and varies inasmuch as the rotor of the pilot motor being connected with that of the main machine, the stator of the pilot motor being suitably arranged for an angular displacement and

moves by reaction, carrying with it the brush yoke ring, and regulating in this way continuously the speed of the main machine, in order that it be identical with the speed of the pilot motor. To avoid hunting of the shaft of the main machine, the movement of the stator of the pilot motor, as well as that of the brush yoke ring, is damped.

A third fundamental arrangement, still following the example of the series three-phase commutator machine, provides the primary winding of the commutator machine upon the rotor, whilst the secondary winding is placed upon the stator and connected with a stationary commutator. The brush yoke ring is placed loose upon the rotor shaft of the main machine and is driven by a pilot axle, in the same way as in the embodiment of Fig. 1 the commutator **103** was driven, mounted loose upon the axle **104**.

The speed of the rotor or driving device is regulated by regulating the speed of the brush yoke ring, by means of the pilot device. In relation to the rotor, the movement of the brushes is an angular displacement of ±150 electric from its neutral position.

The fourth fundamental arrangement provides an arrangement similar to the precedent one, with the difference that the brush yoke ring is fixed upon the rotor, whilst there is an angular displacement of the commutator mounted upon the stator. The electric connection between the stator and the commutator winding is obtained by means of flexible conductors or sliding contacts. As in the second arrangement, the rotor of the pilot motor is mechanically connected with the rotor of the main machine, whilst the stator of the pilot motor—arranged for an angular displacement—is connected in an identic way with the commutator. The regulation is obtained as follows: When the stator of the pilot motor moves through the effect of reaction, it carries the commutator with it, the rotor of the pilot being coupled rigidly with the shaft of the main motor. To avoid hunting, it is necessary to damp suitably the regulating movement.

Besides these above said four fundamental arrangements and of which Fig. 1 is one of the most interesting, there are many other possibilities of application of this invention.

Fig. 2, for instance, provides the commutator structure independent of the main motor and upon the pilot device. Also here the controlled machine is a series three-phase motor. As shown, the primary winding is placed upon the rotor **201** and the commutating winding upon the stator **202**. The power is fed to the rings U—V—W connected with the primary winding, and the circuit extends from said rings through the rings X—Y—Z and through the transformer **203** to the brushes X_1—Y_1—Z_1. The bars of the commutator **204** placed upon the pilot shaft **205** are connected with a corresponding number of rings **206**, which are in connection with the commutation winding of the stator **202**. For the sake of clearness the pilot motor **207** is shown as a three-phase induction motor fed at the terminals U_1—V_1—W_1. To avoid hunting, a demper is provided, the outer member **208** of which is fixed to the pilot axle **205**, whilst the relative inner member **209** is loose upon said axle. The movement of the driving shaft **210** is transmitted to said member **209** by a belt or chain **211** and by the pulleys **212** and **213**, or by means of other transmission systems. With this arrangement a commutator of only 2 or 4 poles may be provided, whilst the main motor may have a multiple number of same.

This arrangement is without flexible conductors, whilst it is provided with a certain number of contact rings and relative brushes. It is especially adapted for motors with very low speed. As said before, also in this case the damper is provided, and, if the transmission between driving axle and pilot axle must be rigid, stopping members may be provided, in order to limit the displacement of the regulating members within about ±150° electric, avoiding in this way current rushes and the leaving of the synchronism, in case of excessive overload or irregular control.

Another similar arrangement is obtained by providing the commutator **204** fixed and the brushes X_1—Y_1—Z_1 rotatable about the pilot axle, reducing in this case the rings to three, which correspond with the three brushes X_1—Y_1—Z_1.

In order to decrease the speed and the commutation frequency at normal speed, cascade connections with ring induction motors may be provided.

If the machine to be regulated has a limited commutation zone, as for instance the direct current machines, the displacing space of the regulating member may be reduced considerably and an auxiliary automatic regulation may be arranged by means of control contacts arranged at the stopping members which limit the movement of the regulation member. In this way, for instance, the feeding tension may be varied, the excitation may be varied, on the whole any known regulation may be obtained, for instance, through an auxiliary arrangement driven by the above said actuating contacts. In this case, the device being object of this invention has only the task of a limited and precise regulation, whilst other devices of known construction can be provided for more important regulations. In an analogue way the movement of the commutator could be reduced, according to the example in Fig. 1, to 10°/20° electric, instead of the said 300° electric, and the brushes could be rendered movable by means of a suitable motor actuated by contacts, arranged adequately at the stopping member. It will be understood that these contacts provide a regulation having the same sense as the regulation limit obtained by said stopping members.

There are also possible some constructions which allow the application of auxiliary poles, for the improvement of the commutation.

The described machines may work as motor as also as generator. They are therefore particularly adapted for lifting devices, elevators, lifts, etc., that require numerous and repeated startings and stoppings, and where the load varies from a highest positive value to a lowest negative value.

Due to the constant selfregulation, the feared self-excitations, which cause sudden and unexpected stops, are avoided.

Further it is not necessary that the pilot motor be an electric motor. It may be realized by a hand-transmission or by a transmission which is in a definite relation with a particular machine, or with the driving shaft of the commutator machine itself. It may comprise also a hydraulic, compressed air or steam turbine or the like. As pilot device are particularly adapted any types of electric variable speed motors, and therefore especially direct current motors with variable tension feeding, as the known and so-called

Ward-Leonard motors. Pilot motors with different number of poles, as in the example of Fig. 1, may be arranged, or several motors with different speeds may be coupled upon the pilot axle, or different supplemental loads for speed regulation may be provided, coupling for instance different centrifugal brakes upon the pilot axle, each of them corresponding with a definite speed, being commutatable among themselves either the different motors or the different centrifugal brakes, according to the required speed.

The speed of the pilot axle may also be regulated by means of supplementary loads in form of mechanical, hydraulic, electric, magnetic brakes and the like.

It is further possible to regulate the revolution number of whole motor groups, so that the ratio between the speed of the different motor remains constant or has to vary in a definite measure. This may be realized by connecting electrically all the pilot motors with one of the known control systems, or using a common pilot shaft, by which each single commutator machine is controlled.

It is, however, always necessary that the pilot axle be resilient, so that it may follow easily those small movements suitable to avoid hunting between driving axle and pilot axle. Of course, the transmission means between the pilot axle and the regulation member have to be reversible and of good efficiency. The use of worms and helicoidal gears is therefore not possible.

Through the displacement movement of the regulation member, there may be actuated also some springs, and in this way the characteristic of the pilot motor and in consequence the characteristic of the main machine may be changed at pleasure, or through the said regulation movement, for instance control contacts, adapted to regulate the speed of the pilot motor and in consequence that of the main motor, may be actuated.

In certain cases it is advisable and in others it is indispensable to bring the regulation member in the neutral position before the starting of the machine. This may be obtained by means of retrieving springs, as by means of a suitable device controlled by the same pilot motor and other special devices, which control the position of the regulation member in relation to the motor. Said neutral position may be controlled by means of magnetic lines, luminous or other rays, sliding contacts and the like.

In order to avoid that at the moment of the starting, should the regulation member not be in neutral position and the driving shaft have to move in the opposite sense as desired, the pilot motor may be switched on a moment before the main motor.

To avoid too sudden starting, if the regulating member at the moment of the switching on is near the position of the greatest starting torque, stator rheostats may be connected in series-circuit relation with the motor, which will afterwards be excluded.

An important organ for these arrangements is the damper. Said damper may assume many structural embodiments. In any case a very sliding damper is required, with gradual action, the damping effect of which, however, has to increase with the increasing of the rapidity of the regulating displacement. Therefore hydraulic, magnetic or air dampers are adapted. The mechanical friction dampers, however, are not adapted. The damper may be placed upon the driving axle, the pilot axle or upon a special auxiliary axle.

Fig. 3 shows an example of a hydraulic damper, when the regulating member is on the rotating part of the commutator machine, as it is the case of Fig. 1. As may se seen, it comprises an outer cylindrical body **301**, composed of two parts tightly assembled, and of an inner body **302** which faces and is very closely spaced to the outer one, in order to avoid a mechanical friction. One of the two bodies depends on the pilot shaft and the other one on the driving shaft, to which they are connected respectively by means of the pulleys **303** and **304**. The inner of the damper contains a liquid that fills the space left between the said bodies, generating a hydraulic friction when one of said bodies moves against the other one. When the damper is rotating, the liquid is under the centrifugal force; this latter distributes it equally upon the whole of the circumference, increasing the pressure and generating in consequence a more sensible friction, which increases the damping effect. The friction may be increased considerably through adequate shagreening or small teeth upon one or both the two damping bodies.

The running out of the liquid at resting damper is avoided by means of suitable circular vanes **305** projecting against the inside, whilst at moving damper the running out is avoided through the centrifugal force.

When the regulating member is placed upon the fixed part of the commutator machine, the damper may be of the type as in Fig. 3, suitably dimensioned, or of a type with piston.

Another important detail is the electric connection of the regulation member. It has to be constructed such as to generate but a slight friction and to require the smallest controlling effect, taking always in consideration the hunting mentioned before. Using the commutator as regulating member, the use of flexible conductors is suitable, as the number of same is considerable; whilst in the case of brush displacement, as said conductors get reduced to a few ones, sliding contacts could easily be used, for instance in form of disks, with the advantage of a smaller friction, contrary to ring contacts. In case of three-phase current, they get reduced to three.

The number of said flexible conductors may be reduced considerably, when using a shunt winding and connecting the equipotential commutator bars among themselves. As the conductors between the winding and the commutator are passed by electric current only during the moment the brushes are in contact with the relative bars, their section may be reduced proportionally.

Fig. 4 shows the arrangement of the flexible conductors in the case of a commutator movable in relation to the rotor winding, as for instance in the case of Fig. 1. Upon the rotor shaft **401** are keyed the bundle of stampings **402**, the pressure means **403** and the disk **404**, whilst the commutator **405** is loose. The ends **407** of the commutation winding **406** are arranged in right order upon a suitable disk **404**, where they are connected with the flexible conductors **408**, which connect the winding with the bars **409** of the commutator **405**; **410** and **411** are rings to keep the flexible conductors in their place, and that especially with regard to the centrifugal force; **412** is an insulating ring. With this arrangement the stress of the material is reduced to a minimum. The required space too is minime. According to the displacing angle, which varies with the number of poles, and according to the

disposable space, the conductors may be arranged also in form of flexible ribbons, instead of flexible strands. With regard to a greater flexibility, a minor stress of the material and a smaller dimensioned room, particular forms may be studied. The flexible conductors **408** may, according to the disposable space, instead of being bent towards the centre of the shaft **401** from the winding, they could be bent towards outside and bent back again, to be connected with the commutator.

Fig. 5 shows the arrangement of the flexible conductors in relation to a brush yoke ring placed upon the fixed part of the machine in case of three-phase current. In said Fig. 5 the brush yoke ring **501** is placed so as to obtain an angular displacement corresponding with the regulating field of 150° electric about. **502** is the fixed yoke ring. **503** and **504** are the respective current terminals and **505** the flexible conductors in form of a tress, a ribbon or the like, being passed by the current. In order to assure in all the positions the two rings **501** and **502** may assume to each other, an adequate position of the flexible conductors **505**, a very small stress upon them and a small driving effort, said flexible conductors are kept by suitable bows **506** and **507**. However, other arrangements are possible, as, for instance, disk shaped sliding contacts, with the advantage of a minor friction, contrary to ring contacts.

The examples described until now provided the application of the invention at series three-phase motors, as the three-phase system of the electric energy distribution is the most diffuse. However, the invention may be used for alternating, single-phase and polyphase-current commutator machines, as well as also for direct current machines of any kind and with series, shunt or compound connection. The invention is provided for the application at the Schrage and Deri motors and other systems with double brush sets.

As said before, devices are known, as for instance, electric joints or speed reducers, which are placed between two different shafts, as for instance between the shafts of the primary motor and a machine to be driven. The arrangement may be as follows: The shaft of the first motor, called primary shaft, carries, for instance a rotating magnet wheel with direct-current excitation—as that of the synchronous generators—whilst the shaft of the driven machine, called secondary shaft, is connected with the stator. The stator itself is therefore arranged so as to rotate together with the secondary shaft.

When the rotor is rotating, a tension is induced in the stator winding, and when this latter is closed directly in itself or through adequate resistances, a current passes through it, and this current generates a torque upon the stator, so that it tends to follow the rotor.

The operation is similar to that of an induction motor.

The speed of the rotor in relation to the rotating stator corresponds with the slipping of the induction motors.

The speed of the secondary shaft may be regulated by means of resistances. The disposable torque may in this case reach at the most the disposable torque of the primary shaft. Providing the primary shaft with a flywheel of inertia, there may be obtained also for short moments a greater torque, using of the kinetic energy accumulated in the flywheel itself.

The slipping energy may be used by feeding with it an auxiliary motor with a fixed stator, whilst the rotor is coupled with the secondary shaft. This auxiliary motor may also be combined suitably with the electric joint or reducer in question.

In this way may not only be obtained an about two to three times greater torque than the normal one, but there is also the possibility of the running reversal of the secondary shaft, whilst the primary shaft continues its running. Using for this device the principles of the commutator motor, the speed of the secondary shaft may be regulated by means of angular displacement of the brushes or of the commutator, instead by means of resistances.

The type of current to be used may be chosen at pleasure, and may be direct, alternating, single-phase or polyphase. Using for said devices as electric reducers the object of this invention, as it has been described before, there may be obtained a speed of the secondary shaft which may be regulated at pleasure and with any required accuracy. Also in this case it is the task of the pilot axle to control the brush or the commutator regulation, overcoming the friction of same.

The number of revolutions of the secondary shaft is regulated through the regulation of the revolutions of the pilot device.

The number of revolutions of the secondary shaft is not influenced by the load variations or eventual speed oscillations of the primary shaft. The speed characteristic of the secondary shaft also may be changed at pleasure.

As in the above described cases of electric motors, the joints or electric speed reducers in question, driven according to this invention, work always automatically, with the best obtainable efficiency for each load, as the brush position is continuously and automatically obtained, so that the working conditions are the best ones. The transmission of the mechanical power may be effected from the primary shaft to the secondary shaft or vice versa. According to the arrangement, a braking action is also obtainable at the secondary shaft, and in consequence the load may take also negative values.

PLACIDO FLURY.

PUBLISHED
JUNE 15, 1943.
BY A. P. C.

P. FLURY
DEVICE FOR THE SPEED REGULATION OF ELECTRIC COMMUTATOR MACHINES
Filed June 13, 1939

Serial No. 278,941

2 Sheets-Sheet 1

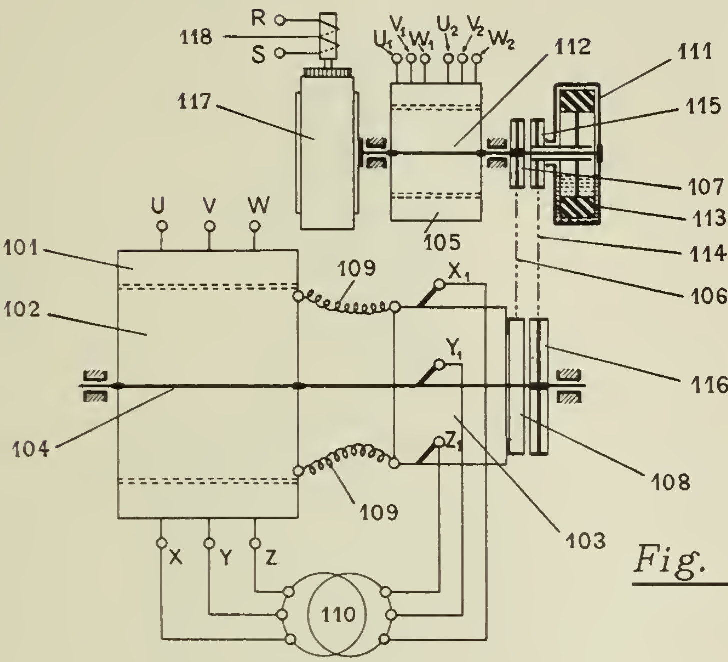


Fig. 1

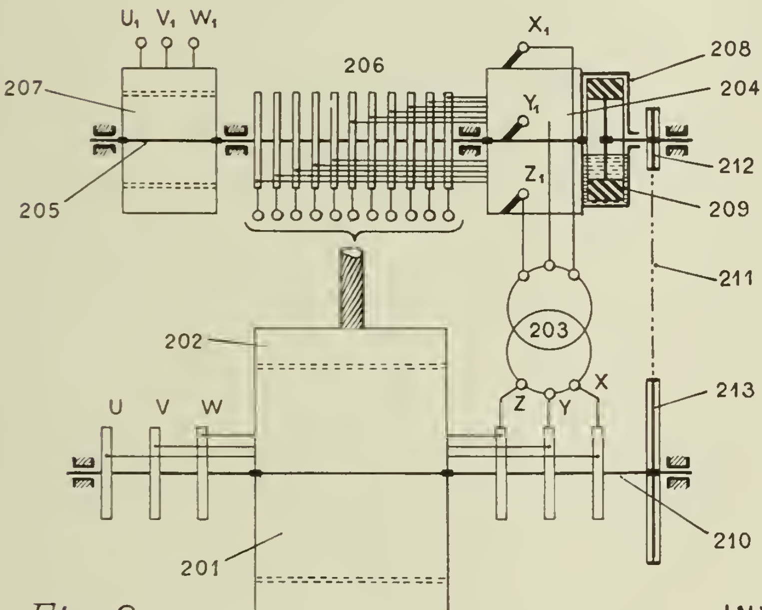


Fig. 2

INVENTOR

PLACIDO FLURY

By

Young, Emery & Thompson
ATTYS.

PUBLISHED

JUNE 15, 1943.

BY A. P. C.

P. FLURY

DEVICE FOR THE SPEED REGULATION OF ELECTRIC COMMUTATOR MACHINES

Filed June 13, 1939

Serial No. 278,941

2 Sheets-Sheet 2

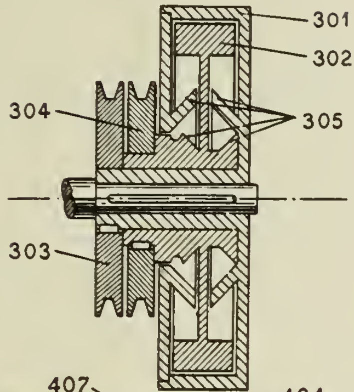


Fig. 3

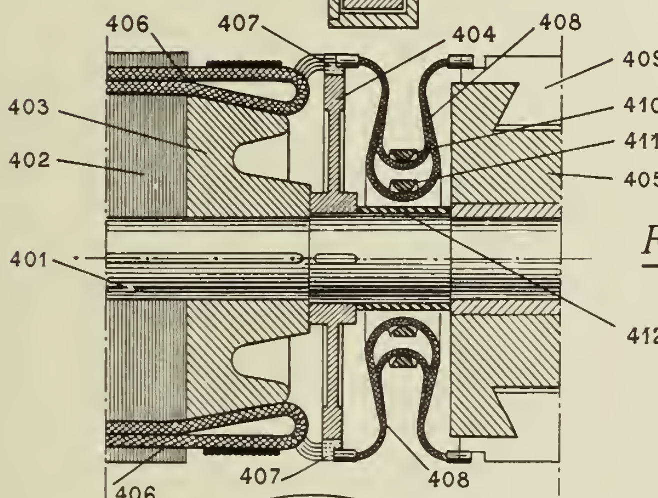


Fig. 4

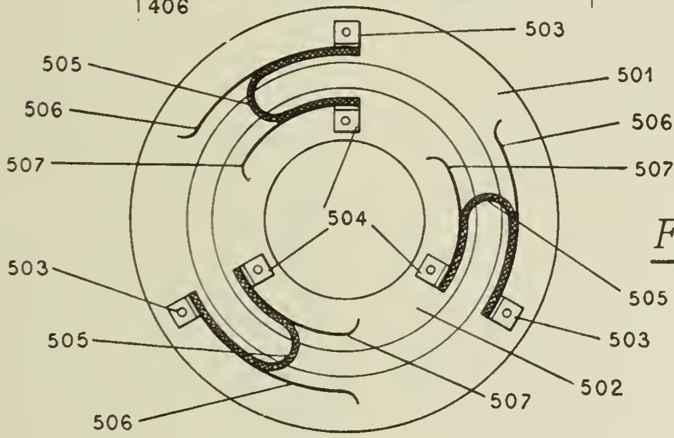


Fig. 5

INVENTOR

PLACIDO FLURY

By

Young, Emery & Thompson

ATTYS.

Published June 15, 1943 Serial No. 281,735

ALIEN PROPERTY CUSTODIAN

METHOD OF FIRMLY UNITING RUBBER WITH INSERTS OR APPLIED LAYERS OF FIBROUS MATERIAL

Otto Giese, Fulda, Germany; vested in the Alien Property Custodian

No Drawing. Application filed June 28, 1939

This invention relates to a method of firmly uniting rubber with fibrous material inserts or applied layers which are to be used for strengthening rubber products, e. g. covers for pneumatic tires, inner tubes therefor, hose piping, driving belts, conveying bands and so forth.

Up to now such inserts or applied layers have as a rule been provided with adhesive, e. g. rubberised, in order to bring about a suitable union or greater resistance to separation between the individual layers of fibrous material and the caoutchouc layers. The union between fibre and rubber in this connection is the more difficult the smoother the fibre is. As a consequence the union of rubber with artificial fibres, such as for example artificial silk or cellulose wool, which are to-day frequently used for fibrous material inserts, offers greater difficulties than the union of caoutchouc with natural fibres.

It has now been found that these difficulties are removed and a greater hold between the rubber and the fibre obtained immaterial of whether the fibre is natural or artificial, if, as provided by the invention, there is used as binding agent a substance which degrades or breaks down rubber, e. g. resorcinol, phenyl hydrazine, hydroquinone, pyrogallol or the like, with which either the fibrous material layer or layers as such, and/or the textiles (fibres, threads, cords) used for their production before the working up thereof to the insert or applied layer, are impregnated or coated.

According to the invention with such a preparation of the fibrous materials the hold between the same and the rubber can be still further increased by adding substances to the rubber mix which during the vulcanisation enter into a condensation reaction with resorcinol, phenyl hydrazine, hydroquinone, pyrogallol or the like. Aldahydes or ketones come into question here or substances which split off aldehydes or ketones in the hot. In practice hexamethylenetetramine, which decomposes to formaldehyde during the vulcanisation, has proved suitable as such an additional material to the caoutchouc mix. This formaldehyde enters in the mix into a condensation on the fibre with the resorcinol, phenyl hydrazine, hydroquinone or pyrogallol, whereby the hold between rubber and fibre is considerably enhanced.

The impregnation of the fibrous materials with resorcinol, phenyl hydrazine, hydroquinone, pyrogallol or a similar agent which degrades or breaks down rubber may be effected by treating the original natural or artificial fibre with such substances. However, the individual finally spun filaments may, before they are twisted for example to a cord filament, be impregnated with resorcinol, phenyl hydrazine, hydroquinone, pyrogallal or the like. Further the cord filaments themselves may be prepared with the rubber-degrading agent. However, a number of adjacently lying filaments may be simultaneously provided with an impregnation of resorcinol, phenyl hydrazine, hydroquinone, pyrogallol or the like. Finally the fibrous material inserts or applied layers prepared from unimpregnated textiles (fibres, threads, cords) or textiles previously impregnated with the rubber-degrading means, for example braided, woven, knitted or worked as cord material, may be impregnated as such with resorcinol, phenyl hydrazine, hydroquinone, pyrogallol or the like.

For example, the fibrous material impregnation may be effected by impregnating the fibres, the individual filament, the cord filaments or the final fibrous material layer, with employment of suitable apparatus, with a solution of the impregnating agent, e. g. in alcohol or some other suitable solvent, and allowing the solvent subsequently to volatilise.

For example preferably artificial silk is impregnated with a 3% alcoholic resorcinal or phenyl hydrazine solution and after drying coated on the calender with a natural rubber or with a mix of artificial rubber, which may have the following composition:

	Parts
Rubber	100
Sulphur	3
Mercapto	0.4
Hexamethylenetetramine	0.3
Zinc oxide	50
Stearic acid	2
Wood tar	1
Phenyl β-naphthylamine	1

The impregnation of artificial silk filaments or fibres with the rubber-degrading agent may also be effected simultaneously during the precipitation of the filament or of the fibre in a precipitating bath containing resorcinol, phenyl hydrazine, hydroquinone, pyrogallol or the like.

Finally the impregnation of the fibre, of the individual filament, of the cord filaments or of the finished fibrous material inserts or applied layers may also be effected by brushing on a solution of resorcinol, phenyl hydrazine or a similar rubber-degrading agent, after the style of lustering.

As compared with the known rubber solution

used heretofore as binding agent in the case of fibrous material inserts or applied layers for rubber products, the use of resorcinol, phenyl hydrazine, hydroquinone, pyrogallol or the like as binding agent has the advantage that the impregnation according to the invention represents not, like a rubber solution, a binding agent of only relatively slight adhesion, always sticky, and making working up to inserts or applied layers difficult, but a binding agent which is smooth and effects the sticking or union of the fibrous material layers with the rubber layers or applied layers only during the vulcanisation of the rubber product.

Of course fibrous substances of all kinds, such as for example artificial silk, cellulose wool, cotton, flax and the like, can be impregnated according to the invention and also the inserts or applied layers prepared therefrom may be used for reinforcing all rubber products irrespective of whether these consist of natural or artificial rubber.

OTTO GIESE.

Published June 15, 1943 | Serial No. 283,196

ALIEN PROPERTY CUSTODIAN

PSYCHROMETERS

Jules Crapez, Mons-en-Baroeul, France; vested in the Alien Property Custodian

Application filed July 7, 1939

This invention relates to an improved psychrometer, and the object of the invention is to provide a direct reading psychrometer in which readings can be taken immediately so as to obtain the hygrometric degree of any atmosphere without having to read, or know the readings of a dry bulb thermometer and a wet bulb thermometer, and without having to make any calculation.

This object is completely attained by the psychrometric device described below, which comprises a special arrangement of a dry bulb thermometer and a wet bulb thermometer, with a mechanical means for actuating a rectilinear rod which can be aligned with the meniscuses formed by the two levels of the thermometer columns so as to indicate on a scale graduated for this purpose the corresponding hygrometric degree.

In addition, this device has the advantage that it can be made specially suitable for a given range of hygrometer readings by varying the respective positions of the thermometer scales of the dry bulb and wet bulb thermometers, both by the relative dimensions of their graduations and by the distance separating the two thermometers.

Figures 1 to 6 of the accompanying drawing show by way of example one embodiment of the invention and the manner of carrying it out in practice.

Figures 1 to 3 explain technically the conditions required for constructing one of these types of psychrometer.

Figures 4 to 6 show an elevation, profile and plan view respectively of apparatus constructed for industrial requirements.

Referring to said drawing, Figure 1 shows that two thermometers 1 and 2 are placed at a certain distance D from one another.

The length of the scale of the thermometer 2 is less than the length of the scale of the thermometer 1. The bulb of thermometer 2 which is the wet bulb thermometer is maintained permanently moist. The highest graduations of each of the two thermometers which here are assumed to have the same thermometric value, are placed at the same level.

A screw 3 actuating a nut 4 provided with a projection 5 supports a rod 6 which can turn freely with said projection.

Another screw 7 actuates a nut 8 which likewise carries a projection such as 9, on which rests the other end of the rod 6 which may or may not be supported in a catch.

The rod 6 moves in front of a scale graduated according to a table of hygrometric degrees for psychrometer reading. If by operating the screws 3 and 7 the rod 6 is aligned with the tops 10 and 11 of the meniscuses of the dry bulb and wet bulb thermometer columns, this rod likewise passes through the point 12 of the scale representing the hygrometric degree sought.

In effect, suppose that the previous position corresponds to a given hygrometric degree. Now suppose rod 6 to be moved to a second position 6′, with positions 13 and 14 of the meniscuses corresponding to the same hygrometric degree represented by the point 12. If N_1 is the number of degrees between the two positions 10 and 13, and N_2 the number of degrees between the positions 11 and 14, and if on the other hand L is the distance from the point 12 to the thermometer 2, we have:

$$\frac{N_1}{N_2}=\frac{L+D}{L} \qquad (1)$$

Now, if the tables for determining the hygrometric degree are considered these tables being prepared on the basis of the number of degrees of the wet bulb thermometer plotted as ordinates and the difference between the degrees shown on the dry bulb thermometer and the wet bulb thermometer plotted as abscissae, it is noticed that all the values of the same hygrometric degree are aligned. Let us assume, therefore, one of these tables and the indication of the values corresponding to 11 and 14 previously taken as an example for the wet bulb thermometer. The values of the hygrometric degree H and H_1 represented by the point 12 on the scale of the apparatus are aligned and cut at 0 the axis showing the readings of the wet bulb thermometer (see Figure 2). If $Th1$ and $Th2$ represent the numbers of absolute degrees between the point of intersection 0 and the point representing the wet bulb temperatures, and if E1 and E2 are the differences between the wet bulb thermometer Th and the dry bulb thermometer Ts, according to these tables and for the same hygrometric degree we can write:

$$\frac{E1}{Th1}=\frac{E2}{Th2}$$

or

$$\frac{E1+Th1}{Th1}=\frac{E2+Th2}{Th2}=$$

$$(2)\ \frac{Ts1}{Th1}=\frac{Ts2}{Th2}=\frac{Ts1-Ts2}{Th1-Th2}=\frac{N1}{N2}$$

For the same hygrometric degree the ratio

$$\frac{N1}{N2}$$

is therefore constant and equal to the general ratio

$$\frac{Ts}{Th} \qquad (2)$$

deducted from the tables of readings.

The same illustration could be repeated for other values of hygrometric degrees. If the rod 6 passing through 10 does not pass through 11 it will then intersect the scale of the hygrometric degrees at another point.

Consequently, for a given hygrometric degree the point 12 is defined by the relation (1)

$$\frac{N1}{N2}=\frac{L+D}{L}=1+\frac{D}{L}$$

For any value of

$$\frac{N1}{N2}=\frac{Ts}{Th}$$

therefore there is a single value of L.

In order to be able to integrate the scale bearing the indications of the different values of the hygrometric degree within given limits, the value of the graduations of the wet bulb thermometer are reduced in the ratio K, this ratio being greater than unity.

This fact does not alter the equality of the previous ratios (2) which become:

$$\frac{Ts1}{\frac{Th1}{K}}=\frac{Ts2}{\frac{Th2}{K}}=\frac{N1}{\frac{N2}{K}}$$

By reducing T*h*, N2 is reduced in the same ratio.

On the other hand equation (1) can be written:

$$L=\frac{DN2}{N1-N2}$$

If N2 is reduced in the ratio K we shall have:

$$L=\frac{\frac{DN2}{K}}{N1-\frac{N2}{K}}=\frac{DN2}{KN1-N2}$$

As K is greater than 1, it is clear that by reducing N2, L will be reduced.

It has been stated that this psychrometer can be used for taking readings with increased accuracy in some particular region of the scale of hygrometric degrees.

In effect, if at the maximum dry temperature for which the dry bulb thermometer has been designed there is aligned horizontally with this dry division the maximum graduation of a wet bulb thermometer lower than the temperature of the dry bulb thermometer, it follows that on this horizontal line there will be aligned a point of the scale of hygrometric degrees indicating a value below the saturation point, since for this value aligned on the horizontal there is a difference between the readings of the dry bulb and wet bulb thermometers.

This value of the hygrometric degree corresponds at this moment to given indications obtained by a substantially horizontal position of the rod 6 (see Figure 3) which corresponds to the maximum accuracy of reading with a size of thermometer for the range of readings to be effected.

This modified apparatus corresponds in fact to a much larger psychrometer.

An example of an apparatus constructed according to these data is shown in Figures 4 to 6, from which it will be seen that the psychrometer comprises a frame A forming a casing with enlargement A′ for accommodating the water tank, apertures B and B′ for allowing access of air to the thermometers and apertures C for looking at the level of the water in the tank. This frame receives in suitable recesses thermometers 1 and 2, namely the dry bulb thermometer and the wet bulb thermometer, the bulb of the latter being provided with a piece of muslin M dipping into a container such as J which is suitably maintained in place while being capable of easy removal for refilling it with distilled water.

As can be ascertained, the thermometers 1 and 2 have different lengths of graduations, but in this particular construction the highest graduations are placed at the same level. The frame A in the form of a casing encloses screws V and V′ having milled operating knobs 3 and 7. The screw V guided at 3′ at its lower part carries a nut 4 provided with a projection 5 which moves in a slot 5′. The screw V′ guided in the same way at 7′ and carrying a milled operating knob 7 passes through a nut 8 carrying a projection 9 which slides in the slot 9′ at a certain inclination on the board G which is graduated in hygrometric degrees according to a table in use with ordinary psychrometers. The two movable projections 5 and 9 serving for the displacement of a rod 6 must be aligned on the meniscuses formed by the two levels of thermometers 1 and 2. For this purpose one of its ends is pivotally mounted on the projection 5, and the other free end rests on the projection 9 and is guided or retained in a small catch (not shown in the drawing).

It will be understood that under these conditions it will be sufficient to actuate the two milled knobs 3 and 7 in order to bring 6 to the level of the two thermometer columns and to read on the scale G the hygrometric degree corresponding to these two levels.

As can be understood this apparatus is very simple, its mechanism cannot get out of order and on account of the arrangement of the two thermometers which could be varied as stated it becomes possible to specify certain types of apparatus for different well defined ranges of readings, said types of apparatus being consequently suitable for the requirements of some industry or other.

JULES CRAPEZ.

PUBLISHED

JUNE 15, 1943.

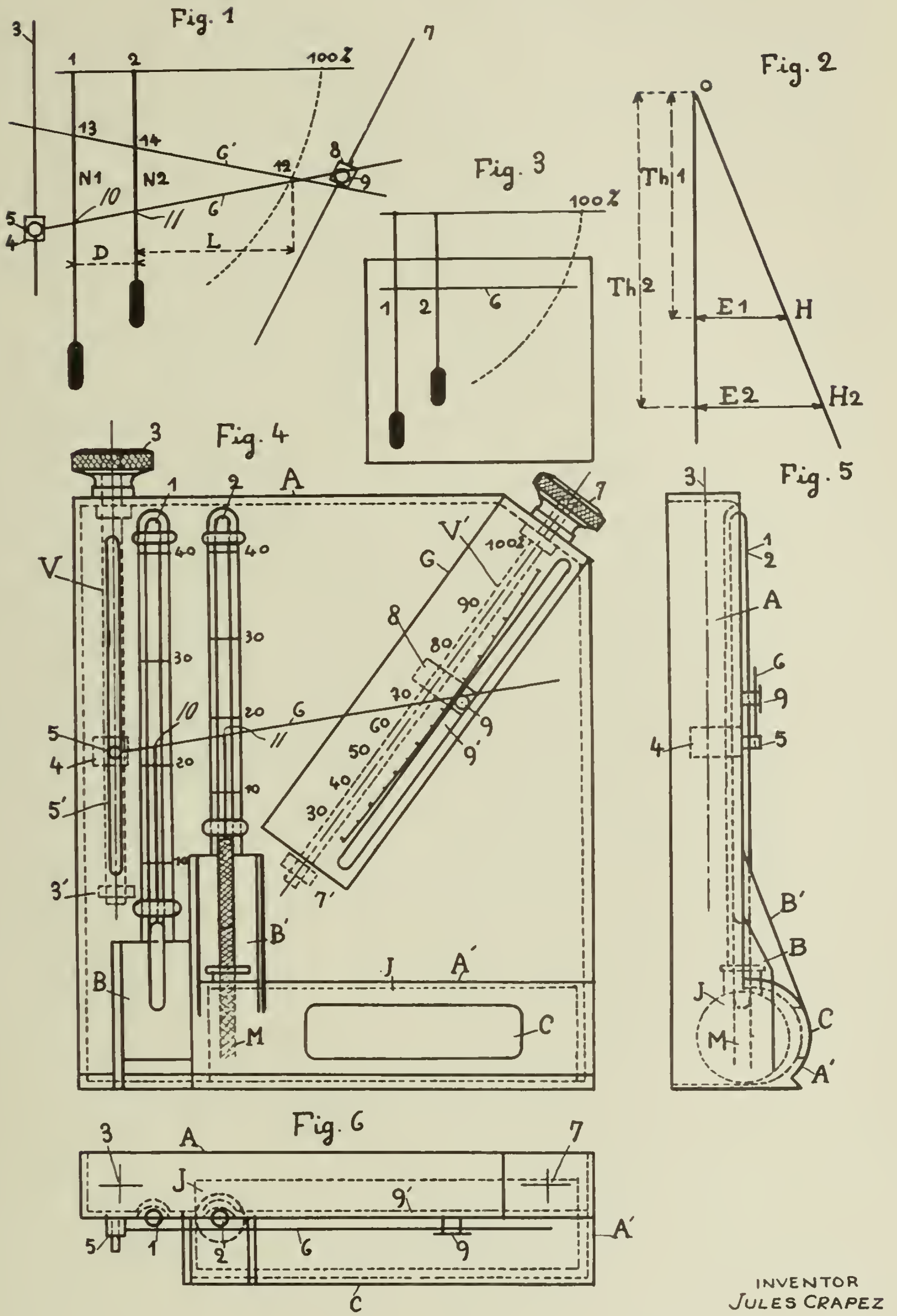
BY A. P. C.

J. CRAPEZ

PSYCHROMETERS

Filed July 7, 1939

Serial No. 283,196



INVENTOR
JULES CRAPEZ

BY Richards & Geier
ATTORNEYS

Published June 15, 1943

Serial No. 284,711

ALIEN PROPERTY CUSTODIAN

CONDENSATION PRODUCTS

Erich Haack, Radebeul, near Dresden, Germany; vested in the Alien Property Custodian

No Drawing. Application filed July 15, 1939

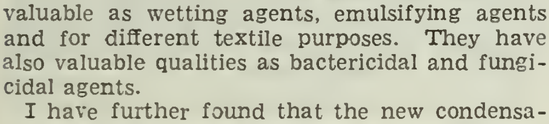
My invention relates to new condensation products and a method of manufacturing the same. It especially relates to compounds, in which an organic acid amide is connected with a tertiary aromatic amine by the CH_2-group. Such products are made by reacting the methylol-compound of an organic acid amide with a tertiary aromatic amine in which the p-position to the amino-group is free from substituents.

According to my invention these compounds or their salts with various acids are especially valuable as wetting agents, emulsifying agents and for different textile purposes. They have also valuable qualities as bactericidal and fungicidal agents.

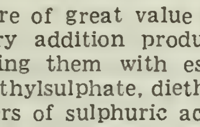
I have further found that the new condensation products are of great value in the form of their quaternary addition products which are made by treating them with esters of strong acids, e. g. dimethylsulphate, diethylsulphate and other alkyl-esters of sulphuric acid, alkyl-esters of sulphonic acids like benzene- and toluene-sulphonic acid, the alkyl- or aralkyl-esters of hydrochloric, hydrobromic and hydrojodic acid etc.

As I have found the condensation of methylol-amides and tertiary aromatic amines can be effected with a good yield according to the following formulae:

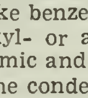
$$R-CONH_2 + CH_2O \longrightarrow R-CO-NH-CH_2-OH$$



that means a tertiary aromatic amine of the formula



in which the p-position to the group



has no substituents, is treated with methylol-derivatives of primary acid amides of the formula $R-CO-NH_2$. R_1 and R_2 stand for alkyl- and aralkyl- and R stands for the residue of a hydrocarbon taken from the class of aliphatic, aromatic and aliphatic-aromatic hydrocarbons. The residue of the aliphatic hydrocarbon comprises chains formed merely of carbon atoms and chains formed of carbon atoms interrupted by links comprising

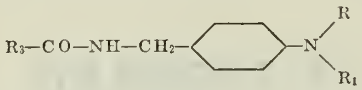
$$-O-,\ -S-,\ -\overset{|}{N}-,\ -OCO-\ \text{and}\ \overset{|}{N}-CO$$

The condensation occurs in the presence of catalysts of acid character able to split off or to bind chemically water, for instance mineral acids, like sulphuric acid, hydrochloric acid, phosphoric acid, salts with acid reaction like zinc-chloride, aluminium-chloride or homopolar compounds like the halogenides of phosphorus, the reaction products of which have an acid nature. Besides other substances combining with water may be present, e. g. acid anhydrides like acetanhydride. As the catalysts of strong acid character, especially mineral acids, may react with the tertiary aromatic amine to form a stable mineral acid salt, it is necessary to use an excess of the amine over the stoechiometric ratio, so that at least one mol of the amine be present in the free form. Generally it may be favorable to use a further excess of the organic base over the lowest ratio which has been calculated, for sometimes a small quantity of formaldehyde, which may be split off from the methylol amide, reacts with the tertiary amine. As it is known, one mol of formaldehyde may combine with two moles of the tertiary amine forming, for instance, tetraalkyldiaminodiphenylmethane. In consequence of this reaction a respective quantity of the amine is chemically bound and therefore is not available for further reaction.

Amides which may be used for the present process are the following, though my invention is not limited to them: the amides of capronic acid, caprylic, capric, lauric, myristic, palmitic, stearic, oleic acid, amides of other natural or artificial fatty acids, or amides of alkylated glycolic or thioglycolic acid, which may be obtained by treating fatty alcohols or mercaptans with chloracetic acid, or amides of amino-acidamides. Other examples of amides are the amides of aromatic carbonic acids, of arylacetic acids, of aryl-oxy-acetic acids, the latter being prepared from phenols and chloracetic acid and many others. The tertiary aromatic amines used in the present process are for instance dimethylaniline, diethylaniline, dipropylaniline, methylbenzylaniline and other symmetric or asymmetric compounds of similar character, N-dialkyl-m-toluidines, N-dialkyl-o-aminophenols or the respective m- or p-compounds or the alkyl- or

aryl-ethers of the same. One may also start from the respective compounds of the naphthalene-, diphenyl- or diphenylmethane series. The reaction may be advantageously accelerated by raising the temperature to about 50–150°. Solvents which are indifferent to the components of the reaction may be present.

The condensation-process runs in the first line forming compounds of the formula

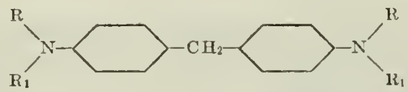


which are soluble in diluted acids. Besides by-products may be forced, f. i. the following methylene compounds of the starting materials:

1. $R_3—CO—NH—CH_2—NH—CO—R_3$

and

2.



Generally only very small amounts of these methylene-compounds are formed. The compounds according to formula I may be condensed in the same process with the aromatic amine or fresh such amine may be added. In this case one mole of the respective amide is split off and a further condensation takes place. The by-products may be easily removed. The compound (I) may be separated as it is not soluble in diluted acids. On the contrary the substituted diaminodiphenylmethane (II) is especially soluble in weak acids, f. i. in a 5–10% acetic acid and it may be easily removed in this manner or it may be removed as it can not be separated out of its solution in mineral acids by the addition of salt.

The compounds which are obtained by the present process are solid or fluid or oil-like substances. They are readily and clearly soluble in diluted mineral acids, like 5% hydrochloric acid, forming solutions with great foaming power. They may be readily precipitated from the acid solutions by adding alkalis or an alkaline salt yielding the free compounds. By the addition of neutral salts the new compounds may be precipitated in the form of salts. By treating the condensation products with esters of strong acids, like dialkylsulphate, they may be transformed into the quaternary ammonium compounds. These quaternary compounds as well as the condensation products themselves may be used as emulsifying, egalizing and wetting agents. They are well suited for textile and colouring purposes and for treating natural and artificial fibres. They may also be used in the manufacture of pharmaceuticals. As they have strong bacterizidal and fungizidal power they may be used as preserving, disinfecting agents and for combatting insects and plant-diseases.

My process may be characterized by the following examples:

Example 1

	Parts
Capriacid-methylolamide	10
Diethylaniline	30
Zinc-chloride	5

are well stirred at ordinary temperature till all methylolamide has reacted. The excess of dimethylaniline is removed by vapour distillation. The residue is soluble for its greatest part in 5% hydrochloric acid, non-basic reaction products being separated from it by extraction with ether. The products of basic character may be precipitated by addition of alkali. They are dissolved in ether and removed from the p-p'-tetraethyldiaminodiphenylmethane which has been formed as a by-product by repeatedly shaking the ether with 10% acetic acid. The condensation product is obtained in a very good yield. It is a light yellow oil, which is readily soluble in diluted mineral acids, yielding a strongly foaming solution. By treating the new compound with 1 mol of dimethylsulphate the quaternary compound is formed, the solution of which is stable when treated with diluted alkalis.

Example 2

The methylolamide of lauric acid	parts	10
Dimethylaniline	do	20
Acetic acid	parts by volume	20
Zinc-chloride	parts	10

are shaken during 20 hours at a temperature of 60°. The reaction product is treated with vapour and the residue is dissolved in a 5% hydrochloric acid. The solution is freed from insoluble by-products by treating it with ether. The hydrochloric acid solution is treated with the equal volume of a saturated solution of common salt. A small quantity of ether is added. The reaction product separates as a fluid intermediate layer between the aqueous solution and the ether. By repeating this precipitation process the new compound is obtained in a pure state. It is a light yellow oil which is readily soluble in diluted mineral acids and has pronounced foaming and wedding power.

Example 3

A mixture of the acids of cocoanut oil is distilled in vacuo, transformed into the chlorides and transformed into the amides by treating with ammonia. 40 parts of this amide are dissolved in 40 parts by volume of toluene at a temperature of about 80°. The solution is shaken for half an hour with one part of dry potassium carbonate and 6,5 parts of paraformaldehyde. The solution is then decanted from the carbonate and mixed with 9,5 parts of concentrated sulphuric acid and 75 parts of diethylaniline at a temperature of 80°. The mixture is shaken for 20–40 hours at a temperature of 80° and the reaction product is neutralized with ammonia and freed from an excess of diethylaniline and toluene by vapour-distillation. The residue, which has a semisolid character, is dissolved in ether, about 3–4 parts remaining insoluble. The solution is extracted with 5% hydrochloric acid. The non-basic by-products remain in the ether. The acid solution is shaken with an equal volume of saturated sodium chloride solution and a small quantity of ether. Upon standing for a while several layers are formed, the intermediate layer containing the new condensation product. This layer is treated two times with equal parts of 5% hydrochloric acid and saturated sodium chloride solution. Now the basic condensation product is precipitated. Its etherial solution is decolourized with charcoal and evaporated. The residue consists of 40 parts of a light-yellow oil, which is clearly soluble in diluted hydrochloric acid.

Example 4

40 parts of the amide of cocoanut oil-fatty-acids, which has been prepared as it is shown in Example 3, is treated with formaldehyde, as it is described there. The product which has been decanted from the potassium carbonate is shaken

for 10 hours with 9.5 parts of concentrated sulphuric acid and 70 parts of dimethylaniline at a temperature of 80°, and then shaken for 20 hours at a temperature of 110°. The reaction mass is treated according the Example 1. A light-yellow oil is obtained in a very good yield. By treating this oil with dimethylsulphate a quaternary compound is obtained, which in the pure state is an almost colorless resin, which easily dissolves in water with neutral reaction. It is very stable when treated with acids or alkalis.

Example 5

40 parts of the amide of cocoa-nut-fatty acids are dissolved in 200 parts by volume of hot 50% hydrochloric acid, treated with 8.5 parts of 40% formaldehyde solution and heated for 2 hours on the vapour bath. The cooled mass is freed from hydrochloric acid by washing with water and dried. 42 parts of methylenedifatty acid amide are obtained. The dry product is heated with 60 parts of diethylaniline and 9.5 parts of concentrated sulphuric acid to about 150° for 20 hours in an atmosphere of carbon dioxide. The mass is well stirred and treated according to Example 3. The same product as described in Example 3 is obtained in a good yield.

Example 6

Cocoa-nut-oil-fatty acids are distilled in vacuo and the fraction of boiling point about 140–200° at 10 mm. is transformed into the amide by heating it with ammonia. 400 parts of this amide are dissolved in 400 parts by volume of benzene and treated for an hour with 70 parts of paraformaldehyde, and 10 parts of potassium carbonate, the temperature being about 80°. To the methylol-compound which has been formed, 800 parts of dimethylaniline are added and then 300 parts of acetic acid anhydride are dropped into the mass, the temperature being kept at 80–85°. The condensation process is completed by slowly adding 50 parts of concentrated sulphuric acid in about one hour. After about 2–3 hours' heating at 80° the condensation is finished. In order to remove by-products and an excess of dimethylaniline the reaction product is dissolved in 2000 parts by volume of benzene and extracted five times with a mixture of 2000 parts of concentrated sodium chloride solution, 660 parts of concentrated hydrochloric acid, 1240 parts of water and 300 parts of acetic acid, all these parts being by volume. Upon standing the solution separates into two layers. Each time the bottom layer is separated off and 550 parts of dimethylaniline may be obtained from the united separated layers. The upper layer of benzene is alkalized by adding 400 parts by volume of a 40% sodium hydroxide solution. The aqueous layer is removed and the benzene solution is dried with potassium carbonate. When the benzene is distilled off, an almost colorless waxy residue is obtained in an amount of 560–570 parts (about 85% of the theoretical yield). 1000 parts of this residue are treated at about 130° with 760 parts of the methylester of p-toluene-sulphonic acid for 5 hours. A waxy yellow mass is formed in quantitative yield, which is clearly soluble in water.

ERICH HAACK.

Published June 15, 1943

Serial No. 286,713

ALIEN PROPERTY CUSTODIAN

METHODS OF FIXING TUBULAR RIVETS

Jacques Francois Gabriel Chobert, Saint-Etienne, France; vested in the Alien Property Custodian

Application filed July 26, 1939

The present invention relates to a method of riveting in which a tubular rivet is upset by drawing through it from the tail end a mandrel having an enlarged head, an opposing pressure being applied to the head of the rivet.

An object of this invention is to ensure that the parts, for instance sheets, to be riveted are drawn tightly together and so held during the riveting operation.

The method of riveting according to the present invention comprises inserting in a hole in the parts to be riveted a mandrel having an enlarged head and a stem carrying a tubular rivet with an axially movable sleeve surrounding a part of said stem and forming an abutment for said rivet smaller in diameter than the hole in the parts to be riveted, disposing the rivet in the hole with its tail end beyond the parts to be riveted, initially maintaining the rivet in this position by means of said sleeve while withdrawing the head of the mandrel through the rivet whereby to upset said projecting tail end of the rivet, retracting the sleeve to allow the parts to be riveted to be drawn tightly together and finally drawing the head of the mandrel completely through the rivet.

The accompanying drawings illustrate by way of example applications of the method of riveting in accordance with this invention using two different forms of rivet.

In the drawings:—

Fig. 1 is a diagrammatic view in sectional elevation showing the use of a rivet having an external collar at each end;

Fig. 2 is a similar view showing the use of a plain tubular rivet; and

Fig. 3 is a similar view of a modification.

Referring to Fig. 1: it will be seen that the lower plate **2** is slightly separated from the upper plate **1** to which it is to be riveted.

The rivet **7** is placed on the mandrel **5** of a riveting machine having two abutments, the inner one in the form of a sleeve **11**, being adapted to be extended beyond the outer abutment **6** by a distance exceeding the space that may exist between the plates to be drawn and secured together. The assembly is then passed through the hole **3** in the plates so that the lower collar **9** of the rivet **7** projects below the lower plate **2**; it is necessary for this purpose that the greatest external diameter of the rivet should be less than the diameter of the hole **3**.

When the mandrel is drawn upward by the riveting machine the upper end of the rivet butts against the sleeve **11** allowing the head **4** of the mandrel to expand the lower collar **9**, the external diameter of which is increased beyond that of the hole **3** provided in the plates.

The sleeve **11** is then released, and retracts within the outer abutment **6** which is pressed into contact with the plate **1**. The mandrel draws up the rivet but, since the lower collar **9** has been expanded, it can no longer pass through the hole **3** in the plate **2**, and consequently raises said plate and presses it tight against the plate **1**.

While the two plates are pressed together the mandrel is drawn completely through the rivet, expanding the shank **7** to fill the hole **3** in the plates and then expanding the upper collar **9**[1], causing it to grip the upper plate **1**.

Fig. 2 shows an application of the invention in which the rivet is a simple tubular member, the head as well as the tail being deformed in the upsetting operation to secure the rivet.

The rivet **7** is threaded on the mandrel **4**, the sleeve **11** bearing against the upper or head end of the rivet and the assembly is inserted into the hole in the plate **1**, so that the lower portion of the rivet projects below the plate **2**. Partial withdrawal of the mandrel then expands the tail of the rivet which extends below the plate **2**.

When this portion of the rivet has been expanded, the sleeve **11** is released and is retracted within the outer abutment **6**.

On continuing to ascend, the mandrel draws upward the rivet **7** and the plate **2**, which is pressed against the plate **1**. When the two plates are in contact the abutment **6** and sleeve **11** bear against the upper plate **1** and the rivet respectively; the mandrel is then drawn completely through the rivet **7** and both the stem and the head, thus securing it in position.

Fig. 3 shows a modified arrangement in which the upper plate **1** is countersunk as indicated at **10** to receive the expanded head end of the rivet.

JACQUES FRANCOIS GABRIEL CHOBERT.

PUBLISHED
JUNE 15, 1943.
BY A. P. C.

J. F. G. CHOBERT
METHODS OF FIXING TUBULAR RIVETS
Original Filed Feb. 16, 1938

Serial No.
286,713

Fig. 1.

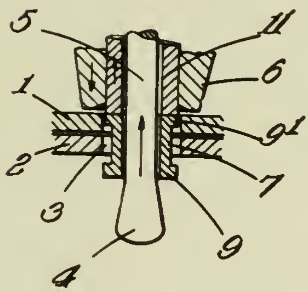


Fig. 2.

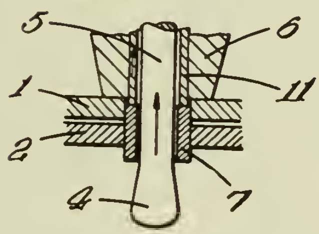
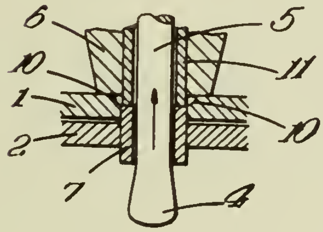


Fig. 3.



Inventor
Jacques F. G. Chobert
by Wilkinson + Mawhinney
Attorneys.

Published June 15, 1943 Serial No. 286,744

ALIEN PROPERTY CUSTODIAN

CYLINDERS OF INTERNAL-COMBUSTION ENGINES WITH COMBUSTION - AND - WHIRLING CHAMBERS IN THE PISTONS

Luis Leizaola, Anglet, France; vested in the Alien Property Custodian

Application filed July 27, 1939

This invention relates to mixing and combustion chambers in the cylinders of internal-combustion engines of the liquid-fuel or constant-pressure-combustion type such as Diesel engines, or the like, and is more particularly concerned with the construction of such chambers.

It is generally admitted by those skilled in the art that it is of high importance for the efficiency of the engines of this type to introduce the liquid fuel into the engine cylinder or cylinders so as to be animated therein with strong whirling or turbulent movements or eddy currents. In general, the fuel injection begins some degrees before the end of compression; at this moment, the engine cylinder piston approaches to its head-end dead center and moves slowly, so that the air bulk confined thereon is practically immovable, and with the arrangements hitherto in common use it is impossible to impart thereto notable turbulence movements.

In contradistinction thereto, this invention aims to provoke at this very moment, strong turbulence movements which will subsequently be maintained throughout the injection period or during a notable fraction thereof, so as to cause the air and the incoming fuel liquid to be intimately mixed together.

According to this invention, a suitable chamber is provided in the engine piston on or/in its head or adjacently thereto forming, at the end of compression, both the combustion chamber and the mixing or turbulence chamber; the liquid-fuel spraying nozzle or nozzles open directly into this chamber the inner wall sides of which are so incurved or inwardly curved as to guide in desired sense turbulence or whirling movements of the gases within the chamber which communicates with the engine cylinder space by means of openings arranged so as to form or define at the end of compression, in cooperation with the opposite surfaces of the cylinder combustion head, conduits or passages of very narrow cross-section disposed or oriented tangentially to whirling trajectories in the interior of the chamber. At the end of compression, the air is thus forced to flow with high velocity and in desired direction in the turbulence or mixing chamber.

The said chamber may be provided in the very head of the engine piston or it may be formed within a separately attachable member secured to the piston head and thermo-insulated therefrom more or less completely to prevent high temperature in the combustion chamber from being transmitted to the remainder of the piston and from deleteriously affecting good operation thereof, and the chamber from cooling.

The present invention is particularly readily applicable to engine cylinders having two opposite pistons which are movable in opposite directions; in this case, the head of one piston performs with respect to the other piston the part of a combustion or cylinder head. All the arrangements which will be described hereinafter may be applied indifferently to an engine cylinder having fixed combustion head or to a cylinder having two movable opposite pistons.

The invention may be carried out in numerous manners. In one series of embodiments of the invention, the chamber provided in the head of the engine piston or in that of one of the two pistons has a large opening through which it communicates with the cylinder barrel; it will be only at the end of compression cycle, when the piston is in the vicinity of the cylinder head or the opposite piston head, that owing to cooperating opposite surfaces in the cylinder head or in the opposite piston the communication of the piston inner chamber with the cylinder barrel is reduced to narrow conduits or passages conveniently disposed or oriented.

In another series of the embodiments of the invention, the combustion and turbulence chamber provided in the piston is nearly entirely closed and communicates with the cylinder barrel through relatively narrow conduits or passages which open in the chamber tangentially to a circumference of whirling, and their cross-section of communication with the cylinder barrel remains invariable almost throughout the stroke of the piston; at the end of compression, the said cross-section is reduced to very small dimensions owing to the approach to one another of opposite surfaces conveniently arranged in the cylinder head or the opposite piston head. Thus, the volume of the chamber arranged in the piston remains invariable throughout the compression stroke, while the volume comprised between the piston and the cylinder head or the opposite piston simultaneously decreases, resulting throughout this stroke in a stream of air flowing through the tangential conduit or conduits, whereby the air thus introduced is caused to whirl within the chamber from the beginning of the compression stroke. Such whirling is actually not necessary at this very moment, but being subsequently maintained throughout the compression stroke it will help in establishing desired turbulence currents by the maximum of velocity at the beginning of fuel injection. When the pistons are

in the vicinity of one another their relative speed is considerably decreased, and the opposite piston head begins to reduce the cross-section of the passages provided for admitting the air into the chamber, thereby accelerating the velocity of the inflowing air resulting in very vigorous whirling or turbulence currents. The openings in the piston chamber and the cooperating surfaces of the cylinder head or the opposite piston head are so arranged that the stream of air, which so far has penetrated in the chamber begins to grow thin and to attack tangentially the inner turbulence currents a shorter distance from the chamber axis than precedingly, resulting in secondary eddy or turbulence currents which contribute to causing the air and the fuel to be intimately mixed together, thus abridging the ignition time and improving the combustion.

The combustion and turbulence chambers constructed as just described have also the advantage of diminishing the engine's knocking, for the combustion first takes place within the chamber and some time will go on before the burnt or burning gases pass into the cylinder barrel, the chamber outlet openings hindering the velocity of the outflowing gases and a sudden increase of pressure on the pistons. On the other hand, by abridging the ignition time, the turbulence currents will also diminish said knocking.

In the aforesaid two series of embodiments of the invention, the combustion and turbulence chamber may be constituted by a cavity formed in the piston only, or it may be constituted by two similar cavities, one being formed in the piston head and the other in the cylinder head or the opposite piston head, these two individual cavities forming at the end of compression one single chamber communicating with the cylinder barrel as hereinabove explained.

Whatever may be the disposition of the combustion chamber, it will be advantageous to provide the inner wall thereof with serrations substantially at right angles to whirling or turbulence movements therein for the purpose of forming small secondary eddy or turbulence currents to contribute to causing the air and the injected atomized oil fuel to be intimately mixed together in the chamber, and also for preventing the oil fuel from contacting with hot chamber walls to avoid to a great extent the oil cracking phenomenon.

In particular, the combustion chamber may be of cylindrical, conic or conic-cylindrical shape, or more generally it may have any suitable form of revolution about an axis registering with one piston diameter or parallel to the piston head. The fuel spraying nozzle or nozzles will then, of course, be oriented parallelly to said axis; in the case of a chamber closed on its top portion, it will be convenient to position the spraying nozzles so that their axis be a certain distance below the axis of the chamber, for the purpose of preventing certain nozzle jets from being momentarily masked by the top wall of the chamber, or the nozzle jet from striking against the said wall. It is to be noted that in fact the fuel injection generally begins some degrees before the top dead center be reached by the piston and that the injection finish some degrees thereafter; in other terms, the piston has not yet reached the end of its upward stroke when the injection begins, and the piston has already started downwards before the injection be finished.

In order that the invention may be more easily understood and readily carried into effect, the same will now be described with reference to the accompanying drawings which show preferred embodiments of the invention and are not to be construed in a limiting sense.

Fig. 1 is an axial sectional view of a four-cycle engine cylinder head, with a piston having a lateral combustion chamber; Fig. 2 is a plan view of the piston head.

Fig. 3 is an axial sectional view of a double-acting engine cylinder each of its two opposed pistons having a combustion chamber diametrally arranged in the piston head.

Fig. 4 is an axial sectional view of a modified form of combustion chambers diametrally arranged in two opposed piston heads; Fig. 5 is a plan view of one of these pistons.

Figs. 6 and 7 are axial sectional and plan views of another modified form of combustion chambers diametrally arranged in two opposite piston heads.

Figures 8 and 9 are axial sectional and plan views of two opposed pistons having their lateral combustion chambers disposed oppositely to one another.

Figures 10 and 11 are axial sectional and plan views of two opposite pistons having their diametral combustion chambers almost entirely closed.

Figures 12 and 13 show a modified form of the arrangement shown in Figures 10 and 11.

Figures 14 and 15 are axial sectional and plan views of two opposite pistons one of which has a combustion chamber almost entirely closed.

Figures 16 and 17 show a modified form of the arrangement shown in Figures 14 and 15.

Figures 18 and 19 show another modified form of the arrangement shown in Figures 14 and 15.

Fig. 20 is an axial sectional view of still another modified form of the preceding arrangement.

Figures 21 and 22 are plan views of other forms of diametral combustion chambers.

Figures 23 and 24 are plan views of two opposite pistons one of which comprises a coaxial annular chamber having openings on the head thereof which may be partly throttled by corresponding projections on the opposite piston head Figures 25 and 26 are sectional views of the two pistons taken on lines 25—25 and 26—26, respectively, of Figure 23, showing the two pistons at the end of compression cycle.

Figures 27 to 30 illustrate the embodiment of the invention comprising an annular combustion chamber which may be said to operate in a telescope-like manner.

Figures 27 and 28 are plan views of two opposite pistons; Fig. 29 is a coaxial sectional view of the two pistons taken on the line **29—29** of Figures 27 and 28; Fig. 30 is the evolution of a section of the two pistons in their telescoped position at the end of compression cycle, following the line X—X in Fig. 27.

Figures 31 to 35 illustrate another combustion chamber of the telescoping type, in the form of a cylinder coaxially shaped in one piston head. Figures 31 and 32 are plan views of two opposite piston heads;

Figure 33 is an axial section of the two pistons taken on the line 33—33 of Figures 31 and 32; Figures 34 and 35 are transverse sections of the combustion chamber taken on the lines **34—34** and 35—35 of Fig. 33, respectively.

Figures 36 to 38 show a modified form of the preceding arrangement; Figures 36 and 37 being

plan views of the opposité pistons and Fig. 38 being the axial section thereof.

Fig. 39 is a plan view of a piston comprising a nearly closed combustion chamber of spherical segment or zone shape with its plane faces perpendicular to the piston head; Fig. 40 is a sectional view of the piston taken through the median plane of this segment or zone.

Fig. 41 is a sectional view showing a particular arrangement of the inside walls of the combustion chambers.

The embodiment of the invention shown in Figures 1 and 2 comprises a lateral outwardly opening chamber 2 of spherical-zone-like shape hollowed out in the barrel and the head of the piston 1 so that it cuts laterally the piston head along a circular arc and has its lateral wall of circular section. The liquid-fuel spraying nozzle 3 has its axis at right angle to the piston head and its jets atomize the liquid fuel uniformly round its axis. The piston head and the opposite combustion head are perfectly plane. The volume of the chamber 2 is so calculated that towards the end of compression stroke the distance between the plane piston head and the combustion head is reduced to a very narrow spacing 5, wherefrom the air comprised therein is caused to rush into the chamber 2 forming a very thin stream which penetrates thereinto with a high velocity in the direction of the arrow thereby producing a violent shock against suitably shaped walls of the chamber 2 and causing desired eddy or turbulence currents to be formed therein;

When the piston, after finishing its compression stroke in the conditions just stated, moves back on its suction stroke the compressed hot gases resulting from the combustion and whirling in the chamber 2 are sucked at high velocity into the increasing suction spacing 5; this suction and the movement which results therefrom maintain whirling or turbulence currents during the end of the fuel injection.

Figure 3 shows an example of application of the invention to a two-cycle engine cylinder having two opposite pistons 6 and 7. The pistons 6 and 7 are provided on their heads with chambers 8 and 9, respectively, each such chamber being of cylindrical shape and hollowed out about one diameter of the respective piston head and the generating lines thereof being parallel to said diameter; the cross-sections thereof are of cardioid-like shape and open up oppositely to one another on the head of each piston, both piston heads being perfectly plane. As precedingly, the volume of these chambers is so calculated that towards the end of compression stroke the distance between both piston heads is reduced to a very narrow spacing 5. The liquid-fuel spraying nozzle 10 the axis of which is oriented parallelly to the generating lines of said chambers opens into the cylinder barrel at equal distance from both piston heads and atomizes the liquid fuel in the cavity formed by the two chambers 8 and 9.

At the end of compression stroke the compressed air comprised in the spacing 5 between the two piston heads is caused to rush into the chambers 8 and 9 forming a very thin stream inflowing with high velocity in the direction indicated by the arrows, thereby producing a violent shock against the circular walls of said chambers and causing desired eddy or turbulence currents to form therein which will be maintained, as previously, when the two pistons begin to move away from one another on suction stroke.

Of course, two liquid-fuel spraying nozzles facing one another may be disposed in the said mixing chambers 8 and 9 at will.

The arrangement just described comprising two cavities facing one another may also be applied to an engine cylinder having a single piston, one of the cavities being then formed in the piston head, while the other one will be provided in the fixed combustion head. It is to be noted that this observation is applicable to all the modified forms of the invention which will hereinafter be described in connection with two opposite pistons.

The embodiment of the invention shown in Figures 4 and 5 comprises the opposite pistons 6 and 7 having cylindrical mixing or turbulence chambers 11 and 12, respectively, which are hollowed out diametrally in the respective piston heads; these chambers 11 and 12 of circular cross-section are preferably laterally slightly offset or stepped relatively to one another; each piston is so shaped that the portions of its head disposed, respectively, at the right and at the left of the mixing chamber opening are on slightly different levels, for example the right hand plane portions *6a* and *7a* are on a little higher level than the left hand plane portions *6b* and *7b*. In these conditions, when the pistons approach to one another, their plane heads form or define two narrow spacings *5a* and *5b* which open into respective chambers 12 and 11 obliquely relatively to the opposite portions of the inner wall thereof. The liquid-fuel spraying nozzle 10 or two nozzles are arranged as in the embodiment shown in Fig. 3. At the end of compression stroke, the air compressed in the narrow spacings *5a* and *5b* is forced into the mixing chambers 11 and 12 forming a very thin stream inflowing with high velocity, thereby producing a shock against the chamber walls and thus causing a very violent whirling or turbulence movement therein, as may be desired.

In the embodiment shown in Figures 6 and 7 each of the opposite pistons 6 and 7 is provided with diametral cylindrical chamber of semicircular cross-section; the respective chamber openings 13 and 14 are opposite to one another; the piston heads are plane, and the respective portions thereof on each side of the central mixing or turbulence chamber are in the same plane.

The opposite plane piston heads are joined to the mixing chamber by means of parallel inclined plane portions; owing to this arrangement, when the pistons approach to one another, the compression spacing 5 between the plane piston heads opens into the mixing cavity on turbulence chamber 13—14 by the medium of two short oblique passages 15 and 16 parallel to one another and having a straight line cross-section of still lesser width than that of the spacing 5, thereby imparting a still higher velocity to the air forced into the mixing chamber from the spacing 5 and causing a violent whirling or turbulence movement to form in the mixing chamber.

The Figures 8 and 9 illustrate an example of opposite pistons or of a piston and a combustion head, each of them having a lateral mixing chamber. Such chambers 17 and 18, each one being similar to the chamber 2 shown in Fig. 1, are open to one another on the plane heads of the pistons 6 and 7. The liquid-fuel spraying nozzle

is positioned in 19 and its axis is parallel to the plane heads of the said pistons and at equal distance therefrom.

The examples hereinafter set forth refer to the embodiments of the invention wherein the mixing or turbulence chamber is arranged either in the piston or in the piston and the combustion head and nearly completely closed and conserves an invariable volume during the compression cycle.

In the examples shown in Figures 10 and 11, the head of the piston 6 is provided with a chamber 20 of substantially cylindrical shape and nearly completely closed. This chamber 20 has a longitudinal slot 21 cut out in its top wall portion along a generating line thereof and opened into the interior of the chamber 20 tangentially to the wall of the latter, and a plurality of passages 22 with their outer mouths disposed along a generating line of said chamber and with their inner mouths tangential to the interior thereof at points approximately diametrally opposed to the said longitudinal slot 21 and in the same sense, said passages 22 being preferably of oblong cross-section in the direction of the cylinder axis. The head of the opposite piston 7 is shaped so as to partly overlap said outer passage mouths 22 and the slot 21 when this piston 7 arrives at the vicinity of the head of the piston 6, thereby reducing the inlet sections thereof and increasing the velocity of the air flowing into the chamber 20, at the moment that the injection of the fuel will take place. The air confined between the two pistons is thus forced tangentially into the chamber 20.

With the chamber thus arranged, a single liquid-fuel spraying nozzle 23 axially disposed may be used, or two axial nozzles may be used, if desired. The nozzle or nozzles may have a single central jet, or they may have three or four jets or even more, circularly arranged.

In the examples according to Figures 10 and 11, as well as in those shown in Figures 12 to 19, the axis of the nozzle or nozzles may be conveniently disposed a little below the axis of the mixing chamber.

Figures 12 and 13 illustrate an arrangement similar to that shown in Figures 10 and 12. The mixing chamber 20 is substantially of the same shape and disposed substantially in the same manner as in the preceding example; but instead of the longitudinal slot 21 a row of tangential openings 24 is employed, and, between the two rows of openings 22 and 24 an intermediary row of tangential holes 25 of smaller cross-section is provided, the tangency thereof being oriented in the same sense. The two rows of outer openings 22, 24 of larger cross-section may be partly closed by the piston 7 when it approaches to the piston 6. The holes 25 of smaller cross-section have for their object to direct into the chamber 20 the air confined within the upper portion of the space between the two pistons, thereby contributing to the formation of eddies or turbulence currents on the entire piston stroke. The fuel spraying nozzle or nozzles are disposed as hereinbefore.

In the embodiment shown in Figures 14 and 15 the piston 6 is provided with a bi-cylindrical mixing chamber 26 of laid-down 8-shaped cross-section to form two eddy or turbulence currents in two opposite directions. The left-hand half-chamber has in its lower portion a plurality of tangential holes 27 of relatively large cross-section and in its upper portion a plurality of holes 28 of relatively small cross-section similarly tangential at their junction with the chamber; also, the right-hand half-chamber has two rows of holes: one row of holes 29 of relatively large cross-section and the other row, 30 of relatively small cross-section holes, and their tangential junction with the chamber is inverse of that of the holes 27 and 28. The object of the rows of holes 28 and 30 of relatively small section located in the upper portion of the chamber is the same as that of the holes of the row 25 shown in Figures 11 and 12.

The fuel spraying nozzle or nozzles employed have at least two diametrically opposed jets registering with the principal axis of the laid down 8.

Figures 16 and 17 illustrate a modified form of the arrangement shown in Figures 14 and 15. The two rows of holes 28 and 30 of Figures 14 and 15 are here united into a single row of holes 31 of relatively small cross-section disposed along the generating line of the upper sharp edge of the 8 and taking care of the two halves of the chamber. The left-hand half of the chamber is also taken care of by a row of passages 27 of relatively large cross-section tangentially joined to its upper portion, while the right-hand half thereof is similarly taken care of by the row of passages 29 of relatively large cross-section.

In the arrangement shown in Figures 18 and 19, the piston 6 is provided with a cylindrical combustion chamber 32 the cross-section of which shows four symmetrical earlap-like portions so as to produce four eddy or turbulence currents. Two rows of passages 33 and 34 face one another at the mid-height of the chamber; the upper portion of the chamber has two rows of passages 35 and 36 of relatively small cross-section tangentially joined thereto in inverse sense. The openings 33 and 34, as hereinbefore, are overlapped by the piston 7 on the end of compression stroke; the smaller openings 35 and 36 are designed for the purpose hereinbefore explained. The form of chamber 32 is particularly suitable to engines of large dimensions. One or two fuel spraying nozzles will be advantageously employed therewith each one having at least four jets crosswise disposed.

In the arrangement shown in axial section in Fig. 20, the mixing chamber 26 formed in the piston 6 is bi-cylindrical and its cross-section is of laid-down-8-shape, as in Figures 5 and 6. However, the chamber 26 has in its top portion one single longitudinal slot parallel to the principal axis of the laid down 8 and upperly expanded so as to receive on the compression stroke a corresponding diametral projection 37 on the piston 7, the said projection while being engaged into the said slot forms or defines two lateral oblique passages the cross-section of which gradually decreases as the pistons approach to one another; the air is thereby forced into the chamber 26 and produces two eddy or turbulence movements in two opposite senses. The fuel spraying nozzle or nozzles are disposed as in Figures 5 and 6.

In the embodiments of the invention hereinbefore described the mixing chamber is not necessarily of cylindrical shape. For example, in the case of using a single fuel spraying nozzle and as shown in Figure 21, the chamber may be of truncated-cone-shape 38, the nozzle being then disposed parallelly to the axis of the frustum of cone. Also, when two opposed nozzles are used, the chamber 39 (Figure 22) may be formed by two coaxial truncated cones connected at their larger bases, or it may be formed by two truncated cones or two spherical caps united by means

of a cylinder, with fuel spraying nozzles axially disposed.

The combustion or turbulence chamber may also be of annular shape or form. One such embodiment of the invention is shown in Figures 23 to 26. The piston 6 here comprises two portions thermo-insulated from one another and bolted together by a central bolt. The upper portion thereof comprises an annular combustion chamber 40 having plane heads and lateral cylindrical walls perpendicular to the plane piston head.

Four oblique conduits 41 of substantially rectangular cross-section are opened upwardly on the upper plane head of the piston 6 and cause the chamber 40 to communicate with the space comprised between the two pistons. All the conduits 41 join the chamber 40 in similar manner. The plane head of the piston 7 is provided with heel-like projections or projecting plugs 42 disposed so as to respectively engage into the outer openings of the said conduits 41 in connection with the two pistons moving towards one another; each projecting plug 42 is obliquely cut on its lowermost end so as to form an oblique face thereon parallel to the oblique face in each corresponding conduit 41. At the end of compression stroke, the plugs 42 engaged into the conduits 41 will define oblique narrow passages for the flow of the air into the chamber 40, as is most clearly shown in Figure 26. The air in this chamber takes a whirling movement in the direction of the arrow shown in Figure 23; the trajectories of eddy movement are located in plans at right angles to the piston axis. The horizontal fuel spraying nozzle 22 injects the liquid fuel obliquely into the chamber preferably in a direction opposite to that of eddy or turbulence movement.

Figures 27 to 30 illustrate another example of annular cylindrical chamber according to this invention, said chamber being formed but at the end of compression stroke by juxta-position of hollow projecting elements provided on each piston.

The plane head of the piston 6 is shaped so as to have, for example, two prismatic projections 43 and 44 the plane bases of which are constituted respectively by two opposite quadrants of the piston head. Similarly, the plane head of the piston 7 has two prismatic projections 45 and 46, but located in the other pair of opposite quadrants for engagement between the former prismatic projections 43 and 44. In each of the said projections are provided annular passages 43*a*, 44*a* and 45*a*, 46*a*, respectively; at the end of compression stroke, the projections of the two pistons are reciprocally engaged, as is shown by their evolution in Figure 30, causing the said passages to form a single annular chamber. It will be noted that the projections 43, 44, 45, 46, when approaching to the plane heads of the opposite piston, form or define narrow spacings, respectively 43*b*, 44*b* and 45*b*, 46*b* wherefrom the air escapes with high velocity into the annular passage in the neighbouring projection; in order to cause the air to circulate in the same direction in these successive portions of the annular chamber, the inlet opening of each passage is larger than its outlet opening and the latter is off-set or stepped in height relatively to the inlet opening, as is most clearly shown in Figure 30. In these conditions, the air compressed in the spacing 45*b*, for example, may flow without obstacle into the inlet opening of the annular passage 43*a*, but cannot be forced into the passage 44*a* situated on the other side, owing to the obstacle opposed by the solid portion of the lateral wall of the projection 44. Thus the air is caused to whirl in the annular chamber in the direction of the arrows as shown in Figures 27 and 30. The fuel spraying nozzle 22 is disposed preferably so as to inject the liquid fuel in a direction opposite to that of whirling or turbulence movement.

The combustion chamber may also be formed by a cylindrical cavity generated by a line parallel to the piston axis, with the whirl movement in planes perpendicular to this axis. The cylindrical combustion chamber 47 (Figures 31 to 35) is located in the piston 6 and has about the same axis as the latter and forms above the piston head 48 a cylindrical protuberance having its head plane and solid. In the lateral wall of this protuberance are provided horizontal conduits 49 causing the chamber 47 to communicate with the space comprised between both pistons. The conduits 49 are obliquely cut out and each of them has for its outer orifice an oblong slot substantially as high as the cylindrical wall in the chamber 47, and they are so shaped within this wall that they open into the chamber 47 tangentially to the inner wall side of the latter at their top portions, whereafter in the downward direction the horizontal section thereof is changed so as to open into the chamber, no more tangentially to the inner wall side but tangentially to a coaxial circumference of lesser radius. The head of the piston 7 is circularly hollowed out so as to be able, at the end of compression stroke, to cap the projecting portion of the chamber 47; the lateral inner wall 50 of the hollow portion of the piston 7 is provided with longitudinal grooves 51 corresponding in number and disposition to the conduits 49. It will also be advantageous to shape in the bottom of said hollow portion an annular recess 52 in communication with all the grooves 51. When both pistons move towards one another, the piston 7 gradually caps the chamber 47; the air is then caused to flow from the grooves 51 into the annular spacing comprised between the engine cylinder and the projecting outer wall of the chamber 47; therefrom the air penetrates into the conduits 49, the outer orifice of which is gradually throttled by the solid portions of the wall 50, whereby the air is forced into the chamber 47 through the conduits becoming more and more narrow which let pass air streams with velocities more and more increased and which, owing to the peculiar shape thereof, tangentially attack the inner eddy or turbulence currents according to circumferences of decreasing diameter as the pistons approach one another. The fuel spraying nozzle 22 is positioned obliquely, following the axis of an inclined conduit opening into the bottom portion of the chamber 47; it is disposed, for example, so as to inject the fuel in the direction opposed to that of the turbulence movement.

In this arrangement, the fact that the chamber 47 is coaxial with the piston causes to provide in its wall a substantially long conduit for introducing the fuel resulting in a rather important dead space; the latter may, however, be reduced with the aid of the modified form of the invention shown in Figures 36 to 38.

According to Figures 36 to 38, the combustion chamber 47 is disposed eccentrically relatively to the axis of the pistons 6 and 7 and has in 53, where it is joined to the lateral wall of the piston 6, an opening for introducing the fuel jet from the horizontal nozzle 22. The head of the

piston 7 is hollowed out so as to cap at the end of compression stroke the cylindrical protuberance formed by the chamber without masking the opening 53; the hollow of the piston 7 has a recessed portion 54 through which the compressed air between the outer head of the chamber 47 and the head of the piston 7 may reach into the free annular space comprised between the inner wall of the engine cylinder and the outer wall of the chamber 47.

Figures 39 and 40 illustrate a modified form of the invention wherein the combustion and mixing chamber is arranged in a manner somewhat similar to that shown in Figures 10 to 13, but modified so as to permit the use of a spraying nozzle in an oblique lateral position relatively to the charge.

According to Figures 39 and 40, the combustion chamber 55 is formed by a spherical segment or zone the axis of which is the straight line 56 and which is laterally limited by two vertical plane faces 57 and 58. In the median plane parallel to the faces 57 and 58, the wall of the chamber 55 is projecting from the piston 6 and has, cut therethrough, air inlet passages 59 all of them inclined in the same manner and opening tangentially to the inner wall and creating a turbulence movement in the sense of the arrows shown in Figure 40. Furthermore, the plane lateral wall 57 is obliquely cut through by two passages 60 and 61, the former being disposed in a horizontal plane and the latter in a vertical plane. The face 58 is cut through by similar passages 62 and 63; these four passages are disposed so as to cooperate for the turbulence movement in the same sense as the passages 59. The fuel spraying nozzle 22 is positioned laterally inclined to the chamber and it injects the fuel into the latter through the passage 64 tangentially to its inner wall and, for example, in the direction opposed to that of the turbulence movement.

Figure 41 shows a cylindrical chamber 20 similar to that shown in Fig. 12, the inner wall of which is provided with circumferential serrations 65 for the purpose of promoting, in contact therewith, secondary eddy or turbulence currents.

LUIS LEIZAOLA.

PUBLISHED

JUNE 15, 1943.

BY A. P. C.

L. LEIZAOLA

CYLINDERS OF INTERNAL-COMBUSTION ENGINES
WITH COMBUSTION-AND-WHIRLING
CHAMBERS IN THE PISTONS

Filed July 27, 1939

Serial No.

286,744

10 Sheets-Sheet 1

FIG. 1

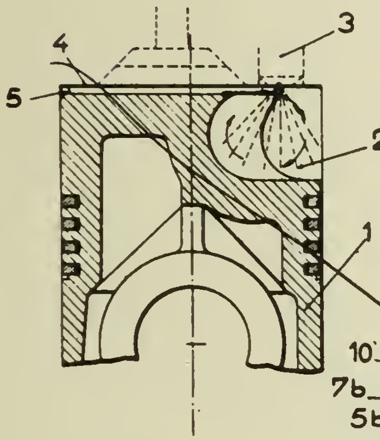


FIG. 4

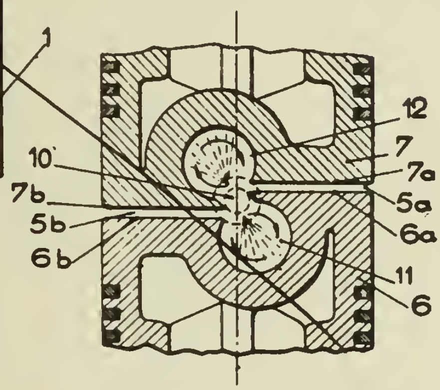


FIG. 2

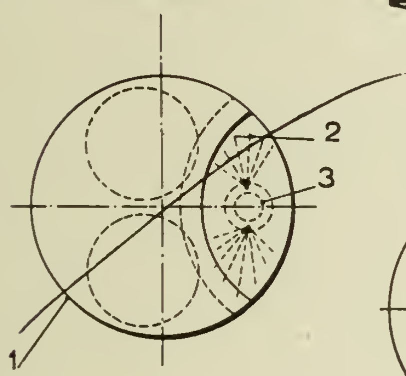
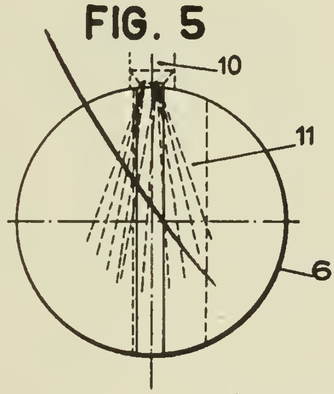


FIG. 5



Inventor
Luis Leizaola
By Williams, Bradbury,
McCaleb & Hinkle Attys.

PUBLISHED

JUNE 15, 1943.

BY A. P. C.

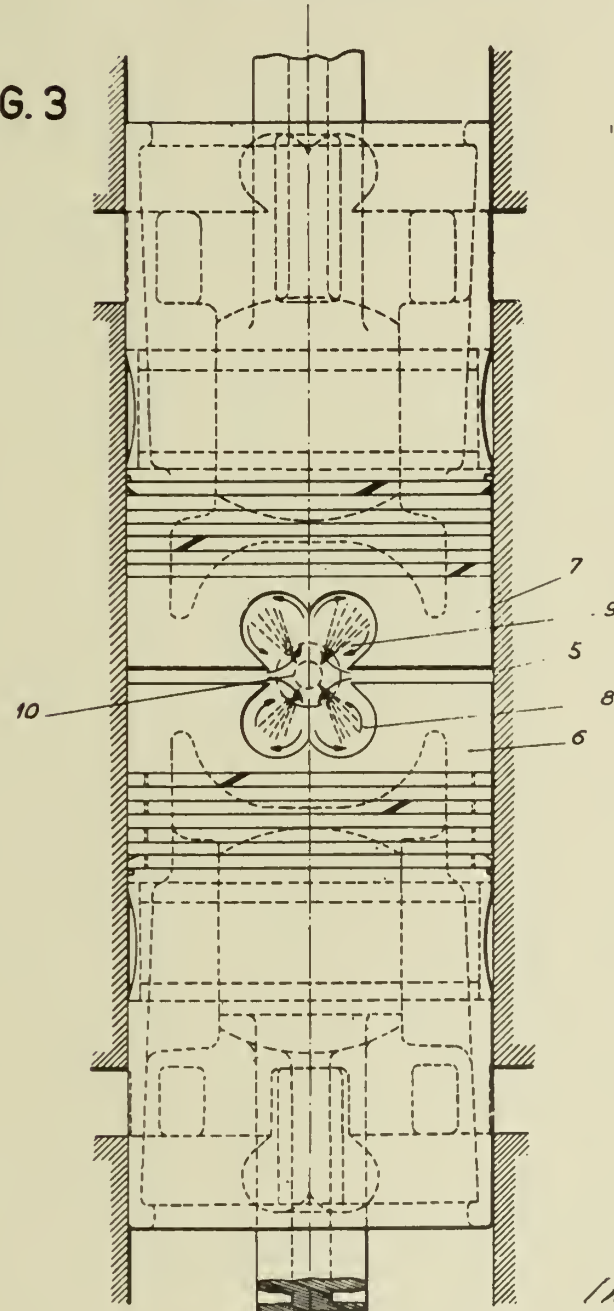
L. LEIZAOLA
CYLINDERS OF INTERNAL-COMBUSTION ENGINES
WITH COMBUSTION-AND-WHIRLING
CHAMBERS IN THE PISTONS
Filed July 27, 1939

Serial No.

286,744

10 Sheets-Sheet 2

FIG. 3



Inventor
Luis Leizaola
By Williams, Bradbury
McCaleb & Hinkle Attys.

PUBLISHED

JUNE 15, 1943.

BY A. P. C.

L. LEIZAOLA

CYLINDERS OF INTERNAL-COMBUSTION ENGINES
WITH COMBUSTION-AND-WHIRLING
CHAMBERS IN THE PISTONS

Filed July 27, 1939

Serial No.

286,744

10 Sheets-Sheet 3

FIG. 6

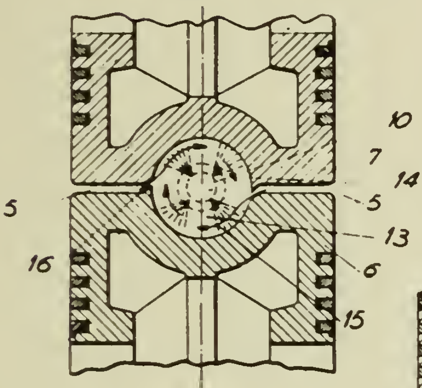


FIG. 7

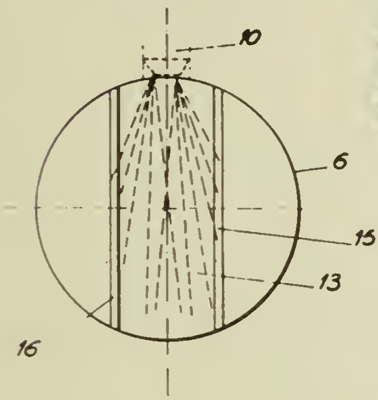


FIG. 8

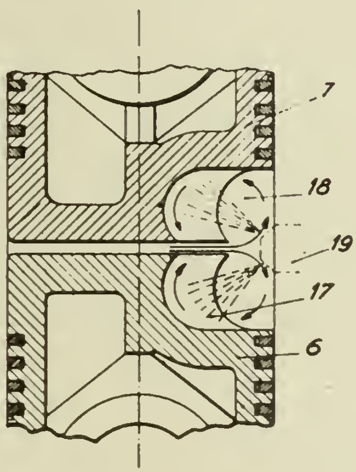
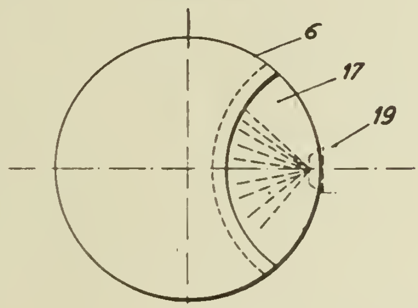


FIG. 9



Inventor:
Luis Leizaola
By Williams, Bradbury,
McCaleb & Hinkle Attys.

PUBLISHED

JUNE 15, 1943.

BY A. P. C.

L. LEIZAOLA

CYLINDERS OF INTERNAL-COMBUSTION ENGINES
WITH COMBUSTION-AND-WHIRLING
CHAMBERS IN THE PISTONS

Filed July 27, 1939

Serial No.

286,744

10 Sheets-Sheet 4

FIG. 10

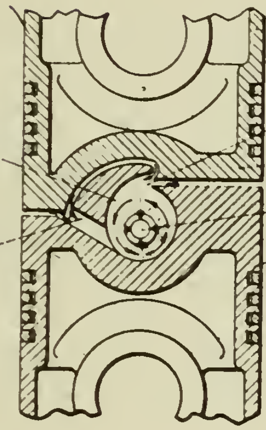


FIG. 12

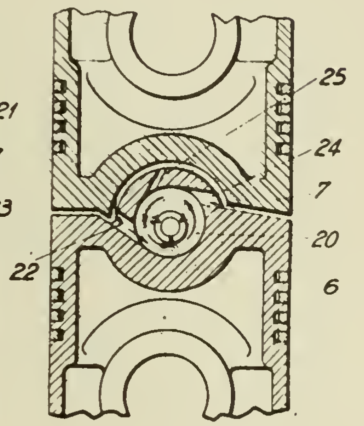
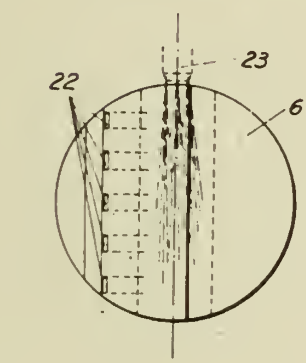
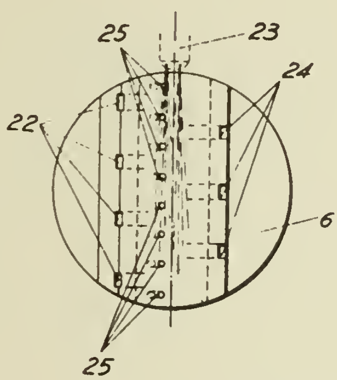


FIG. 11



4

FIG. 13



Inventor.
Luis Leizaola
By
Attys

PUBLISHED

JUNE 15, 1943.

BY A. P. C.

L. LEIZAOLA
CYLINDERS OF INTERNAL-COMBUSTION ENGINES
WITH COMBUSTION-AND-WHIRLING
CHAMBERS IN THE PISTONS
Filed July 27, 1939

Serial No.

286,744

10 Sheets-Sheet 5

FIG 14

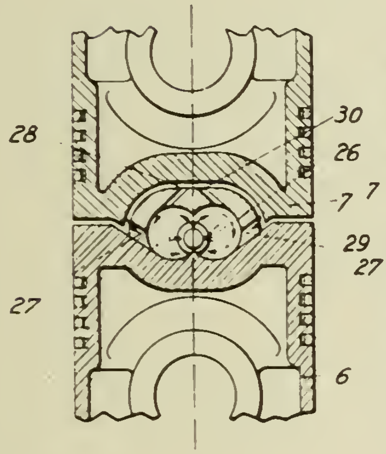


FIG. 16

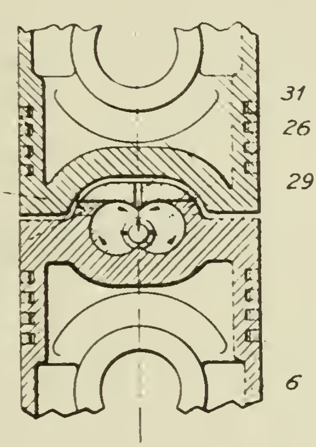


FIG. 15

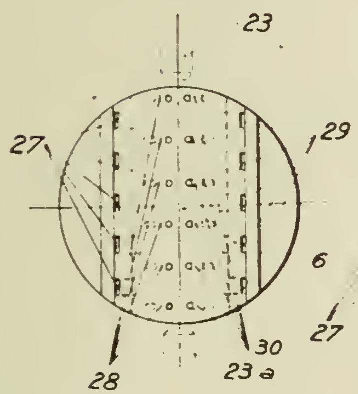
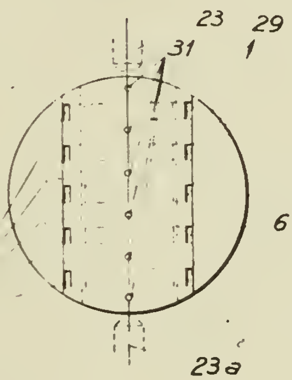


FIG. 17



Inventor
Luis Leizaola
By ... Attys.

PUBLISHED
JUNE 15, 1943.
BY A. P. C.

L. LEIZAOLA
CYLINDERS OF INTERNAL-COMBUSTION ENGINES
WITH COMBUSTION-AND-WHIRLING
CHAMBERS IN THE PISTONS
Filed July 27, 1939

Serial No.
286,744
10 Sheets-Sheet 6

FIG.18

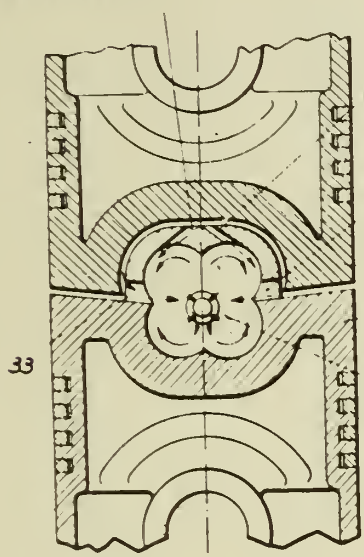


FIG.21

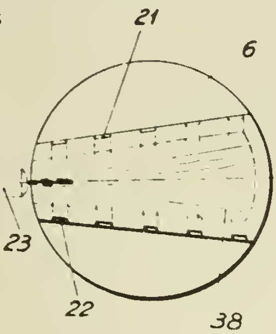


FIG.22

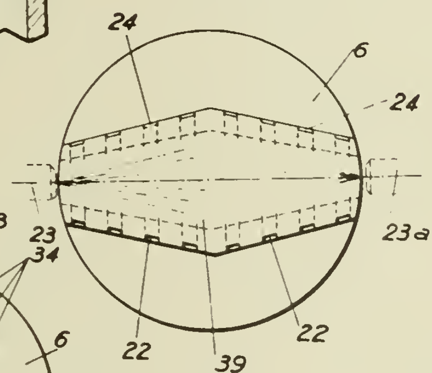


FIG.19

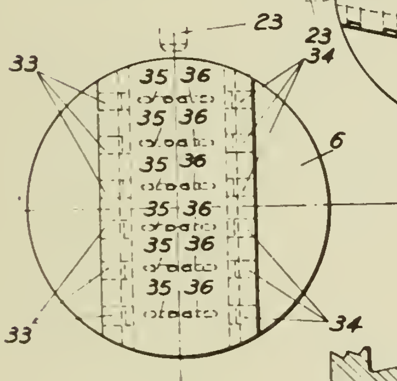
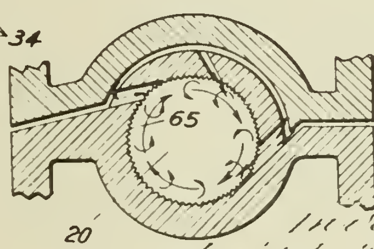


FIG.41



Inventor
Luis Leizaola
By Williams, Bradbury, McCaleb & Hinkle Attys

PUBLISHED

JUNE 15, 1943.

BY A. P. C.

L. LEIZAOLA

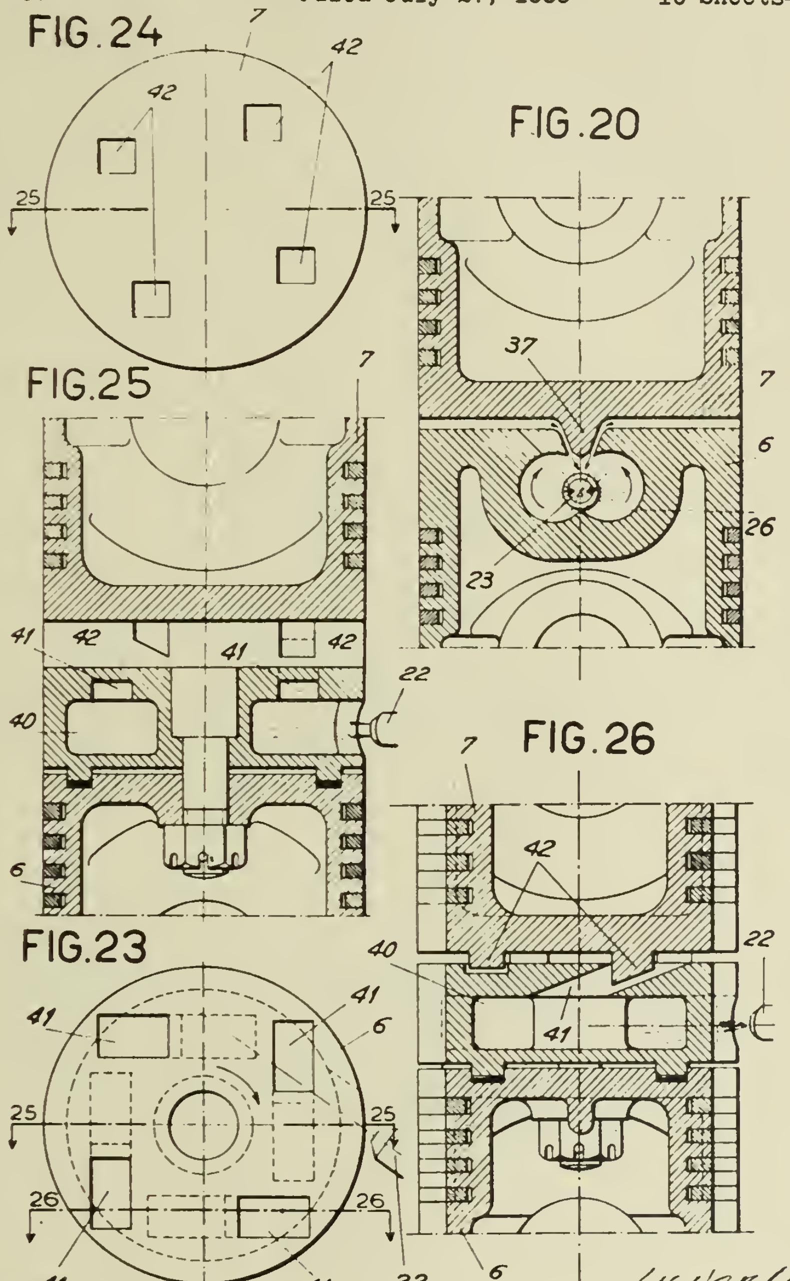
CYLINDERS OF INTERNAL-COMBUSTION ENGINES
WITH COMBUSTION-AND-WHIRLING
CHAMBERS IN THE PISTONS

Filed July 27, 1939

Serial No.

286,744

10 Sheets-Sheet 7



Inventor:
Luis Leizaola

PUBLISHED

JUNE 15, 1943.

BY A. P. C.

L. LEIZAOLA
CYLINDERS OF INTERNAL-COMBUSTION ENGINES
WITH COMBUSTION-AND-WHIRLING
CHAMBERS IN THE PISTONS
Filed July 27, 1939

Serial No.
286,744

10 Sheets-Sheet 8

FIG. 28 FIG. 27

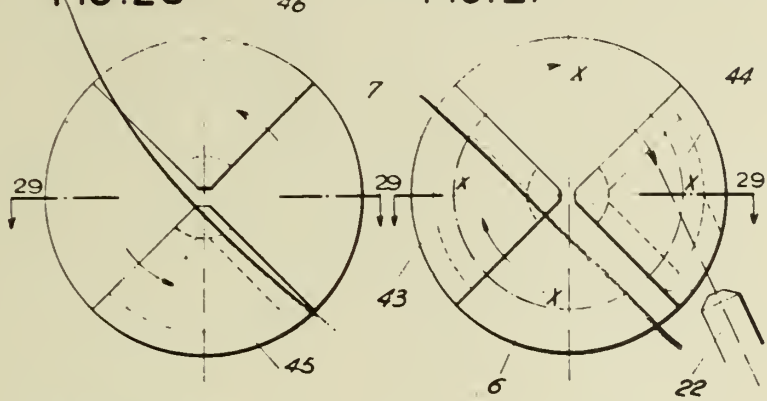


FIG. 29

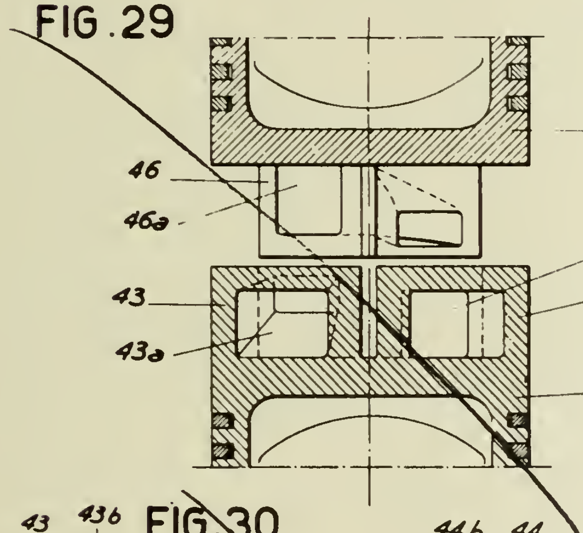
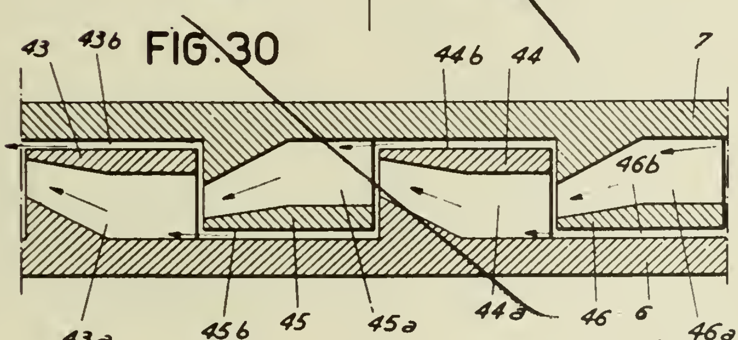


FIG. 30



Inventor
Luis Leizaola
By
Williams, Bradbury, McCaleb & Hinkle Attys

PUBLISHED

JUNE 15, 1943.

BY A. P. C.

L. LEIZAOLA
CYLINDERS OF INTERNAL-COMBUSTION ENGINES
WITH COMBUSTION-AND-WHIRLING
CHAMBERS IN THE PISTONS
Filed July 27, 1939

Serial No.
286,744

10 Sheets-Sheet 9

FIG. 32

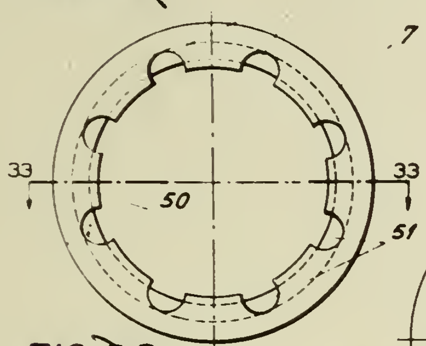


FIG. 34

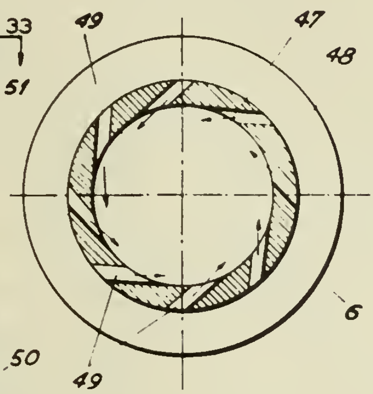


FIG. 33

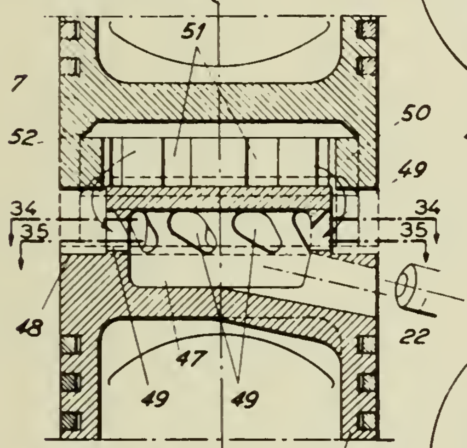


FIG. 35

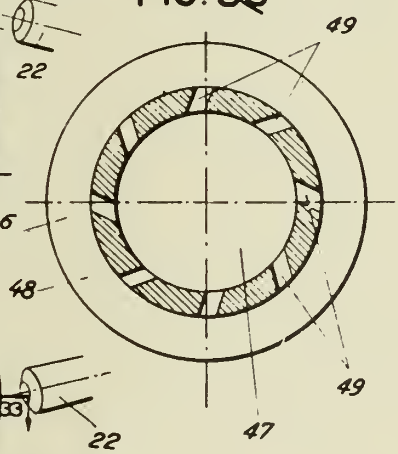
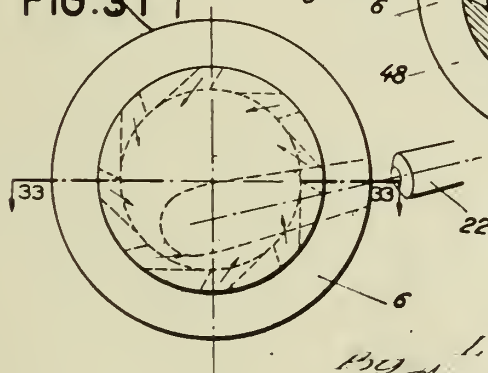


FIG. 31



Inventor:
Luis Leizaola
By [illegible]
[illegible] Attys.

PUBLISHED

JUNE 15, 1943.

BY A. P. C.

L. LEIZAOLA

CYLINDERS OF INTERNAL-COMBUSTION ENGINES
WITH COMBUSTION-AND-WHIRLING
CHAMBERS IN THE PISTONS

Filed July 27, 1939

Serial No.

286,744

10 Sheets-Sheet 10

FIG. 37

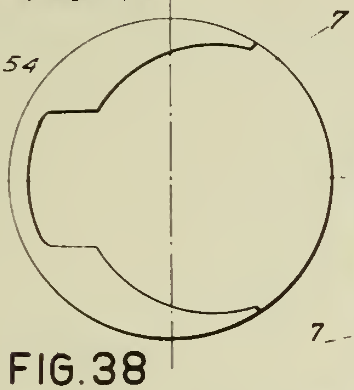


FIG. 40

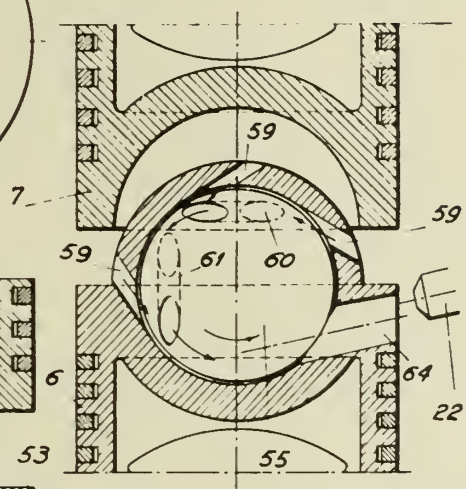


FIG. 38

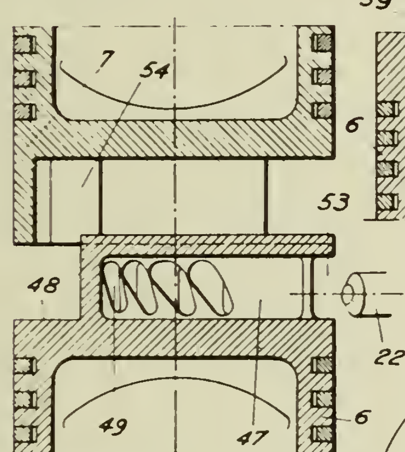


FIG. 39

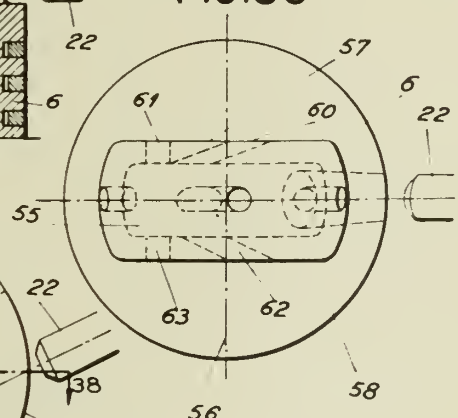
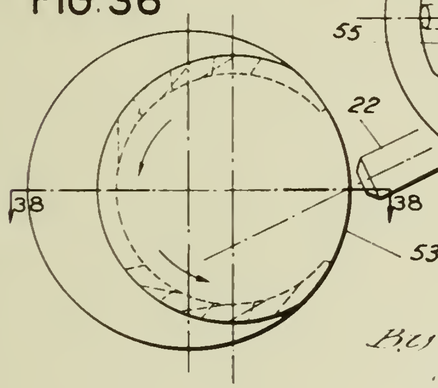


FIG. 36



Inventor.
Luis Leizaola
By Williams, Bradbury,
McCaleb & Hinkle, Attys.

Published June 15, 1943

Serial No. 275,747

ALIEN PROPERTY CUSTODIAN

BALL-AND-SOCKET JOINT FOR CONTROL TRANSMISSIONS

Michel Joseph Meyer, Paris, France; vested in the Alien Property Custodian

Application filed May 25, 1939

The present invention has for object a system of ball-and-socket joints serving to connect control members and generally speaking for all applications.

The various ball-and-socket joint systems commonly used as method of articulation, particularly in the controls of auxiliary movements present, in their applications, inconveniences which are obviated by the ball-and-socket joint system forming the subject-matter of the present patent.

For instance, in the common case which consists in connecting two rods transmitting a longitudinal stress to members moving in different planes, it is established that the actual method consisting in connecting said rods by a transverse finger having a spherical part, generates torsional and bending stresses abnormally straining the parts concerned and creating lateral reactions prejudicial to satisfactory operation. However, these arrangements cannot allow said ball-and-socket joints to function according to an angle sufficiently important for satisfying the requirements of many cases.

Besides this, said ball-and-socket joints are not always provided with the indispensable arrangement for taking up the play, and which must be, in these circumstances, easily adjustable; also, they do not present the advantage of being positively unable of getting out of order. Moreover, they lack, above all things, the indispensable advantage of being rapidly and easily coupled and uncoupled involving complete accessibility.

The present ball-and-socket joint system remedies these inconveniences and has other advantages: it ensures a rational transmission of the stress by eliminating the lateral coupling as well as the prejudicial reactions resulting therefrom, it directly transmits the stress through the axis of the rods carrying the ball-and-socket joint. The spherical part of the ball-and-socket joint located at the end of said rods, constitutes the point about which said rods can pivot in all possible planes up to a maximum amplitude encircling half the spherical part. Said system allows of obtaining rectilinear controls, as the axes of the elements ball and rods can be in alignment with each other; likewise, it allows of obtaining lateral control, so-called right-angular control, under a very large leading angle.

Said ball-and-socket joint system resides in the principle of gripping the male spherical part by means of suitable jaws belonging to the corresponding female part. There are two methods of spacing apart and gripping said jaws which can be obtained either automatically, or by hand, and the movement of said jaws takes place in a plane at right angles to the longitudinal axis of thrust, or axis of the rods, so as to laterally encircle as largely as possible, the periphery of the spherical part contrarily to the actual method of procedure, in which these spherical joints are carried at the end, that is to say in the axis of the rods.

In the accompanying drawing, the representation of which is given merely by way of indication, it will be noted that the gripping method of said jaws consists in causing said jaws to move circularly, by hand, by means of a simple knob and the action of a spring.

In this drawing:

Fig. 1 illustrates an external view of the ball-and-socket joint having circular jaws.

Fig. 2 is a longitudinal section of said pincers showing the method for coupling both parts united.

Fig. 3 is a complementary view of the two first ones showing an external half-view and half-section.

Fig. 4 is a cross section on an enlarged scale, showing the detail of a coupling member called circular jaw, in its closing and locking position.

Fig. 5 is a similar view but showing said member in "open" position during uncoupling.

Fig. 6 is a longitudinal section of a fixed jaw.

Fig. 7 is a plan view of said jaw.

Fig. 8 is a longitudinal section of a movable jaw.

Fig. 9 is a plan view.

The ball-and-socket joint having circular jaws is composed of the two main parts to be connected: on the one hand, the finger **1** having a spherical end **2** rigid with its control member, in this case, the rod **3**; on the other hand: the part which receives the spherical end of said finger and which is constituted by a sheath **4** also rigid with the control member **5**. Within said sheath is secured a jaw **6** having a spherical cavity, forming one with the same.

Opposite this fixed jaw is arranged a circular movable jaw **7** having a spherical cavity, capable of moving circularly under the action of an outer milled ring **8**, to which it is connected by a pin **9** passing through the sheath through a circular opening **10**; a torsional spring **11** placed within said sheath restores the circular jaw **7** to its locking position.

The operation which consists in connecting the said control elements is very simple, as well as that consisting in uncoupling them. In these "circular jaws" it suffices to rotate the movable ring **8** in the direction of the arrow A to bring the movable jaw **7** from the position shown in Fig. 4

to the spaced position shown in Fig. 5, the spherical part 2 of the latter, once placed in its recess, it suffices to abandon the ring 8, which, under the action of the spring 11, Fig. 2, is restored in the reverse direction to that of the arrow, that is to say, to the position shown in Fig. 4; at this moment, the finger is trapped between both jaws 6 and 7 and cannot possible become released therefrom.

For ensuring perfect adhesion of the spherical walls of the circular jaws on the spherical part, and consequently for eliminating play, the central recess of the spherical part 22 is slightly out of center relatively to the external diameter of said jaws; it will be seen that, under the action of the spring 11, the latter grip said spherical part with a normal pressure which automatically ensures the taking up of the play, as well as a safety locking of said spherical part.

It is to be noted that all these improvements are thus united in a simple member of relatively reduced cumbersomeness, which constitutes, among others, one of its main characteristic features.

This system can be applied to all controls by means of levers, links, coupling rods, segment controls, remote controls, and, in short, to all transmission controls which are particularly included in: machine-tools, motor cars, aviation, electric apparatus.

MICHEL JOSEPH MEYER.

PUBLISHED

JUNE 15, 1943.

BY A. P. C.

M. J. MEYER
BALL-AND-SOCKET JOINT FOR CONTROL
TRANSMISSIONS
Filed May 25, 1939

Serial No.
275,747

Fig. 1

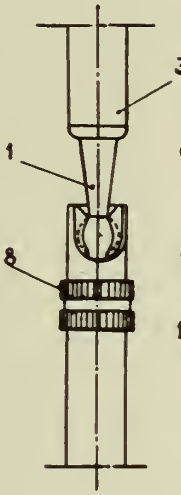


Fig. 2

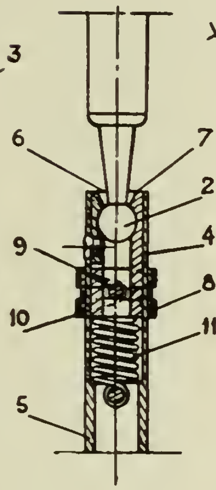


Fig. 3

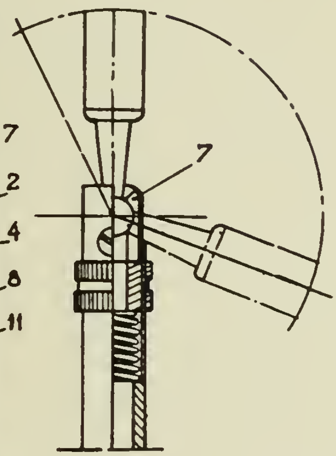


Fig. 4

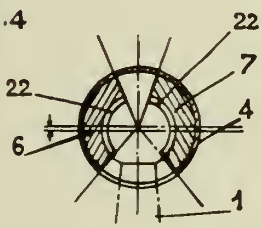


Fig. 6

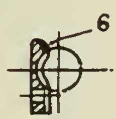


Fig. 8

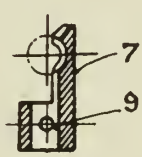


Fig. 5

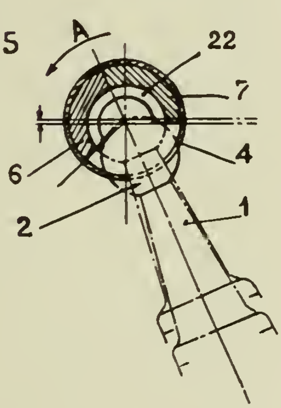


Fig. 7

Fig. 9

Inventor,
M. J. Meyer

By: Glascock Downing & Seebold
Attys.

Published June 15, 1943 Serial No. 287,348

ALIEN PROPERTY CUSTODIAN

ELECTRIC CIRCUIT-BREAKERS WITH COMPRESSED FLUID BLOW OUT

Bernard Marie Hilaire Paul Fernier, Lyon, France; vested in the Alien Property Custodian

Application filed July 29, 1939

This invention relates to electric circuit-breakers and more particularly to those which themselves supply the energy required for blowing the arc.

Circuit-breakers which themselves supply the energy required for blowing the arc generally comprise means for storing up potential energy during the operation of closing the contacts and then deliver said energy on separation of the contacts to impart to the fluid for blowing the arc a certain degree of pressure. Compressed air is generally used to blow the arc. The potential energy referred to is predetermined for a given type of apparatus. When the intensities of the short circuit currents to be broken exceed a certain value, the type of circuit-breaker referred to can no longer be used, as it then becomes necessary to supply supplementary energy from a source outside or apart from the circuit-breaker.

One of the objects of the present invention is to provide an electric circuit-breaker with compressed fluid blow out and which supplies its own energy for blowing the arc, in which the rupturing power is increased. With this object in view the circuit-breaker in accordance with the invention contemplates the production by said circuit-breaker of a supplementary quantity of energy over and above a given intensity of current which passes through the arc at break, said supplementary quantity of energy being supplied from a different source from the latter for effecting the blow out.

In accordance with the invention the two quantities of energy referred to may act simultaneously or else said supplementary energy acts first and produces a preponderating blast, the blast produced by the other quantity of energy not beginning to act until some time after said former quantity.

The invention has other aims and objects in addition to those above set forth, all of which will be readily understood from the following description taken in connection with the accompanying drawing of embodiments of the invention herein given for illustrative purposes, the true scope of the invention being more particularly pointed out in the appended claims.

Referring to Fig. 1 there is therein represented partly in elevation and section and partly in perspective a circuit-breaker of the general type described comprising an air compressor having a piston operated by a spring and tensioned before the closing of the contacts of said circuit-breaker, said spring being capable of storing up in advance the energy required for the closing and separating of said contacts as well as the energy required to produce the compressed air required for blowing the arc.

In said figure the compressor piston 1 is connected on the one hand to the free end of a powerful spring 2 and on the other hand to a cam 3 which is operated by mechanism herein shown in perspective for the sake of clearness. A shaft 4 of this mechanism is directed perpendicularly to the plane of said figure and its projection is shown at 4′ which designates the axis of oscillation of the cam, which is moved by said mechanism in a contra-clockwise direction. In the course of this rotary movement it can engage and carry with it a roller 5 upon one arm of a bell crank lever 6 which controls the main movable contact 7 of the circuit-breaker, the fixed contact of which is indicated by 8. These two contacts draw an arc herein called the principal arc and designated by 9. Said circuit-breaker is further provided with an auxiliary fixed contact 10 and an auxiliary movable contact 11 which, when the intensity of the current to be broken exceeds a given value, draw an arc herein called the auxiliary arc and designated by 12 and which is struck in series with the main arc (or principal arc).

In this figure the circuit-breaker is shown with its arc drawing contacts separated, the action of the cam 3 on the movable contact 7 then being as follows. Said cam has a full portion 3*a* and a cam groove 3*b*. When said cam engages said roller 5 said full portion 3*a* causes the lever 6 to swing clockwise about its fulcrum thus closing said principal contacts 7 and 8. With the circuit-breaker being thus in circuit closing position, said roller 5 is opposite the entrance of said cam groove 3*b*. The separation of said two principal contacts takes place by a further rotation of said cam 3 in the course of which said roller 5 leaves said cam groove 3*b*. The details of this operation will appear more fully below. The auxiliary movable contact 11 is operated by a bell crank lever 13 against the action of a spring 14 which tends to keep the auxiliary contacts 10 and 11 separated. These two contacts are kept in closed position by a bell crank lever 15, one arm of which is opposite the movable core of an electric relay 16 which is energized by the main current passing through the circuit-breaker.

The tensioning of spring 2 to store up energy to close and then to separate the contacts of the circuit-breaker and to blow the principal arc, is effected as follows:

Rotation of the shaft **4** on which is splined the cam **3** is effected by a crank **17** which by means of an endless screw device **18** of which the wheel is loose upon said shaft, and a lever **19** actuates a driving member **20** carried by said shaft. When in its contra-clockwise rotation said cam brings its end *3a* opposite said roller **5**, said spring **2** will be tensioned and a pawl **21** engages a bell crank lever **22** of which one arm is opposite the movable core of a winding **23** adapted to effect closing movement of the contacts of the circuit-breaker. Furthermore, by the tensioning movement of said spring **2** an inclined plane **24** is moved to act upon a roller **25** carried by a bell crank lever **26** and thus through a suitable connection swinging said bell crank lever **13** contra-clockwise about a fulcrum to close the auxiliary contacts **10**, **11**, said lever **13** engaging said bell crank lever **15**.

Closing movement of the principal contacts **7** and **8** of the circuit-breaker is effected by sending an energizing current through the winding **23** which causes the movable core of the latter to swing the bell crank lever **22** about its fulcrum thus freeing the pawl **21**. Said shaft **4** is thus unlocked, and under the action of said spring **2**, said cam **3** is rotated and rotates said shaft **4**. During this time the part *3a* of said cam **3** causes bell crank lever **6** to swing clockwise about its fulcrum to close the principal contacts **7** and **8**. When said contacts are thus closed, pawl **21** engages bell crank lever **27**, one arm of which is opposite the movable core of a winding or coil **28** adapted to effect the separation of said principal contact.

To effect an ordinary separation of said contacts an energizing current is sent through said coil **28**. The resulting movement of its coil rotates said lever **27** and disengages said pawl **21**. Shaft **4** being thus unlocked, cam **3** is caused to rotate by spring **2** which was only partially distended during the closing movement of said principal contacts. However the prinicipal movable contact does not immediately start its movement as the roller **5** passes along the cam groove *3b* from which it is not yet freed. During this time the air at the left of piston **1** is pushed back through a hollow insulator **29** which supports a part of the circuit-breaker and into a chamber **30** in which is located the principal fixed contact **8**, so as not to effect the separation of said two principal contacts until the air pressure for blowing the arc has reached its most efficient value. As the roller **5** leaves said cam groove *3b* thus liberating said lever **6** the latter swings contra-clockwise under the action of spring **31**, and thus separates said principal contacts **7** and **8**, and the principal arc **9** is blown by the compressed air which continues to blow through said chamber **30**, driven by the piston **1** which reaches the end of its stroke under the action of spring **2**.

In accordance with the invention supplementary energy for the blast is borrowed from the auxiliary arc. To this end contacts **10** and **11** are located within a chamber **31** preferably separated from the chamber **30** containing the principal fixed contact as above set forth. The gases generated by said auxiliary arc **12** as well as the air within said chamber **31** the pressure of which is increased to a very high degree by the heat generated by said auxiliary arc, are blown against the principal arc **9**, either directly or after contacting with a flame shield **32** by which they are cooled, the blast thus furnished being of an intensity proportionate to the intensity of the current to be interrupted.

In accordance with the invention also said auxiliary arc **12** forms before the principal arc when the intensity of the current to be interrupted exceeds a certain intensity value. To this end means are provided herein comprising a relay **16** which operates instantaneously but only when said intensity value is exceeded, the coil **28** for separating the contacts being supplied with current by a relay **33** the operation of which is retarded.

When the intensity of the overcharge current to be interrupted is inferior to said intensity value above referred to, the relay **33** alone operates and said coil **28** causes separation of the arc drawing contact as above set forth. On the other hand when the intensity of the current to be interrupted exceeds said intensity value, said relay **16** operates immediately to free said lever **13** which under the action of said spring **14** separates said auxiliary contacts. Furthermore said lever **13** in turning about its fulcrum acts upon the lever **26** to cause the latter also to turn and move the core of said coil **28** through a suitable link connection **34**. The lever **27** is thus freed and the principal contacts **7**, **8** start to separate but only when said roller **5** has escaped from said cam groove *3b*, that is to say after a certain time has elapsed and therefore unmistakably after separation of contacts **10** and **11**.

To the blast produced by said auxiliary arc **12** there is therefore added that produced by piston **1**. To facilitate this the currents of compressed air produced by said arc **12** and said piston are directed against the arc **9** along parallel courses. As shown in Fig. 1, said two air currents are concentric.

Said two compressed air currents act simultaneously and thus combine their blowing action. The blast from piston **1** continues after extinction of the arcs **9** and **12**, thus scouring the space between and about the principal contacts **7** and **8** and precluding any restriking of the arc.

The invention contemplates the use of any suitable arrangement to produce the concentric flow of said two compressed air currents. In the illustrative embodiment of the invention this result may be obtained by using a principal fixed contact which is hollow and the hollow interior of which communicates with the compressor cylinder as shown in Fig. 2. This figure is a longitudinal section of that part of the circuit-breaker containing the principal fixed contact and the two auxiliary contacts the remainder of said circuit-breaker having the same arrangement as that shown in Fig. 1. Referring to Fig. 1 a channel **35** leads from an insulator **29** and conducts the air propelled by piston **1** into the interior space **36** of said main fixed contact **8**.

The interior chamber of the hollow fixed principal contact may communicate with the chamber in which the auxiliary arc is formed. Such an arrangement is shown in Fig. 3. As in the case of Fig. 2 so also in the case of Fig. 3, only that part of the circuit-breaker containing the principal fixed contact and said auxiliary contact is illustrated, the remainder of said circuit-breaker being of the same construction as that shown in Fig. 1. The principal and auxiliary contacts as well as the arcs struck thereby are indicated in said Figs. 2 and 3 by the same reference characters as in Fig. 1. The interior chamber of the hollow fixed contact **8** communicates with the chamber **31** in which the auxiliary

arc is struck and the concentric chamber 38 of said hollow contact communicates with the air compressor which is diagrammatically indicated by said piston 29.

In accordance with the invention a certain degree of simultaneous action of the two compressed air currents referred to may be obtained by directing said currents in opposite directions against said arc 9 as shown illustratively in Fig. 4. In the illustrative embodiment shown in said figure the operation of the main and auxiliary contacts and the generation of the air blast may be and, as is herein shown, are identical with those illustrated in Fig. 1. The corresponding means have been omitted from Fig. 4 in order not unnecessarily to complicate the drawing, only the piston 1, the driving spring 2, the lever 5 for operating the principal movable contact 7, that part of the circuit-breaker containing the principal fixed contact 8 and the auxiliary contacts, as well as the particular means and features to be considered have been shown diagrammatically in order that the invention may be clearly understood. The compressed air heated by the auxiliary arc is conducted to the fixed contact 8, while the air driven by the piston 1 is conducted through said hollow insulator 29 into a cylinder 40 in which said movable contact 7 operates. The gases and the compressed air produced by the arc 12 are directed against that point of attachment of the arc 9 which is within the chamber 41 while the blast of compressed air from the piston 1 is conducted through openings or ports provided in a partition 42 and into a pipe 43 surrounding the movable contact, whence it is directed against the other point of attachment of said arc 9.

The energy for the blast generated by said auxiliary arc and that produced by the compressor may act successively. In that case the blast generated by said auxiliary arc, which always preponderates, starts first and operates alone. The blast from the compressor starts to operate later and adds its operation to that generated by said arc; it scours the space separating and surrounding the contacts and completes the blowing of the arc, thus precluding any restriking of the latter.

Figs. 5, 6, 7, 8, 9, 10, 11, and 12 show illustrative embodiments of the invention for accomplishing the above results.

Referring to Fig. 5 the latter shows a circuit-breaker in which the operation of and means for operating the principal and auxiliary contacts and for generating the air blast for blowing the arc, generated by the compressor and that generated by the auxiliary arc are identical with those of the illustrative apparatus shown in Fig. 1. The only difference resides in the fact that the auxiliary movable contact operates in a chamber 44 and that the air blast from the compressor, conducted through the hollow insulator 29 issues therefrom into said chamber 44.

Fig. 6 shows an illustrative embodiment of the invention diagrammatically in which the principal and auxiliary movable contacts as well as the piston of the compressor are made in a single movable member. The principal fixed contact 8 is carried by an insulator 45. A second insulator 46 located opposite said insulator 45, carries an assemblage of two cylinders 47 and 48 mounted end to end. A pipe 49 is slidably mounted in said two cylinders and carries at its right end the principal movable contact 7 and at its left end the auxiliary movable contact 11. The compressor comprises a cylinder 48 of which the piston 1 is secured to said pipe 49. Said cylinder 47 forms the chamber in which the auxiliary arc 12 is formed. Movement of said pipe 49 is effected by one arm of a bell crank lever 50 upon the other arm of which acts a powerful return spring 51 which tends to keep said contacts 7 and 8 separated from each other. Clockwise rotation of said bell crank lever 50 closes said contacts. Rotation of said lever is effected by a spring mechanism which acts upon the shaft of said lever and is similar to that shown in Fig. 1 but without the piston 1. Operation of closing said contacts and separation thereof are effected exactly as in the case of the apparatus shown in Fig. 1. Separation of said auxiliary contacts prior to separation of said principal contacts is herein conveniently effected by suitably locating the movable contacts 7 and 11 relatively to each other upon said pipe 49. In said figure the auxiliary arc 12 is longer than the principal arc because it was struck prior to the latter. The separation of said principal contacts is prevented at the start of the movement of separation of said auxiliary contact by backing up the fixed contact 8 with a spring to cause it to follow up its movable contact at the start of their separation movement.

The contacts of the circuit-breaker being in closed position their separation is effected by freeing the rotary shaft on which said bell crank lever 50 is fulcrumed. Said lever will then be sharply rotated by said spring 51 thus causing the pipe 49 to slide toward the left of said figure. As already stated the spring which backs up said fixed contact 8 keeps the latter in contact with said movable contact 7 during the beginning of the sliding movement of said pipe 49, whereas said contacts 11 and 12 separate and form the auxiliary arc 12. The air contained in the cylinder 47 is thus put under great pressure and flows through the pipe 49 toward the principal arc 9. On the other hand piston 1 which is integral with said pipe 49 propels the air at its left side through port 52 provided in said pipe 49, into the latter. The two blasts of fluid are thus directed in parallelism against the principal arc 9 to blow the latter.

Fig. 7 shows a modification of the circuit-breaker just described, which is operated the same as the latter. A tube 53 carries at one of its ends the principal movable contact 7 and at its other end the auxiliary movable contact the same as in Fig. 6. This pipe 53 is slidably mounted in two superposed cylinders 54 and 55, the cylinder 54 forming the compressor the piston 1 of which is integral with the pipe 53, while the cylinder 55 forms the chamber in which the auxiliary arc 12 is formed. The formation in succession of the auxiliary arc 12 and the principal arc 9 takes place as in Fig. 6 owing to the fact that the principal fixed contact 8 is backed up with a spring.

The contacts of said circuit-breaker being closed the separation thereof is effected by freeing the rotary shaft upon which the bell crank lever 50 is fulcrumed, thus allowing the latter to be sharply rotated by action of the tensioned spring 51 whereby said pipe 53 is moved toward the left of said figure. By a judicious determination of the length of the lower part of said pipe and thanks to the spring backed fixed contact 8 the auxiliary arc 12 will be struck before the principal arc. The air contained in cylinder 55 is thus put under high pressure and enters said

pipe through a port 56 provided in the latter. On the other hand the air at the left of piston 1 is compressed by the latter and is propelled into said pipe through a port 57. The two blasts of fluid are thus directed in parallelism against the principal arc 9 to blow the latter.

In both of the illustrative embodiments represented in Figs. 6 and 7 respectively, means may be provided, such as a valve for example, to control the port of communication with the compressor cylinder and prevent the entrance into said cylinder of the air and gases emanating from the chamber in which the auxiliary arc is blown.

Such an arrangement is shown in Fig. 8 as applied to a circuit-breaker of the type represented in Fig. 5. As the latter has been described in detail, Fig. 8 shows only what is absolutely necessary for the comprehension of this feature of the invention.

In the passage formed in the hollow insulator 29 and which connects the compressor cylinder with the chamber containing the principal fixed contact 8 there is provided a valve 58 which remains closed so long as the pressure is sufficiently high within the chamber in which the auxiliary arc is struck, and thus prevents passage into the compressor cylinder of the compressed fluid produced by said auxiliary arc. Just so soon, however, as said pressure in said chamber 31 drops below that produced by said compressor, said valve 58 will be raised and the compressed fluid from said compressor is added to that produced by said auxiliary arc, for blowing the principal arc 9.

The invention also contemplates the provision of means, if desired, for preventing the compressed air and gases formed by said auxiliary arc, from driving said piston back at the moment the auxiliary contacts break the circuit. An illustrative embodiment of this feature is shown in Figure 9.

Referring to said figure the circuit-breaker therein shown is similar to that of Fig. 1. The principal contact 8 called "fixed" is mounted upon a support which is slidable in the chamber in which the auxiliary arc 12 is formed under the action of a spring 59 in said chamber. The movable auxiliary contact 11 is carried by said same support. In Fig. 9 the contacts are open. When said contacts are closed the movable contact 7 pushes back the contact 8 and with it said support thus closing the auxiliary-contacts 11 and 12 which form the auxiliary arc. It will be clear that on opening said contacts, movement of the contact 7 to the left first separates the contacts 10 and 11, whereupon said support having its movement by spring 59 arrested by stop 60, contact 8 will also be arrested and contact 7 will separate from the latter to draw the arc.

The closing and separating movements of the contacts of the circuit-breaker are effected by suitable driving means, said means herein illustratively comprising a powerful spring 61 which is tensioned by lever 62 carried by a cam 63 splined upon a shaft 4 similar to the shaft of the spring tensioning mechanism of the circuit-breaker of Fig. 1. When said spring is tensioned the end of the lever 62 is locked by the bell crank lever 64, the lower arm of which can be acted upon by the movable core of the coil 23 of the contact closing mechanism. The operation of closing the contacts frees the lever 64 and said spring 61 is partially distended, thus rotating the shaft 4 by means of the cam surfaces 65 and 66 of the cams 63 and 67 respectively. Piston 1 is thus moved to the left of said figure and the principal movable contact 7 is moved toward the right thereof. The lever 62 is stopped and locked by a pawl 68. The spring 61 has, as stated, been only partially distended the remainder of its potential energy serving to separate the contacts of the circuit-breaker.

The operation of separating the contacts by said coil 28 disengages the pawl 68 from said lever 62 thus freeing the latter. The cam 63 then acts upon lever 69 to move piston 1 toward the right, shortly after the cam 67 which has operated the principal contact 7 controlling lever 7 and previously separated said auxiliary contacts, said contact 11 being moved toward the left by its spring 59, has subsequently separated said principal contacts 7 and 8. Piston 1 thus drives the air at its right toward the insulator 29 and through the latter against the principal arc 9. On the other hand the compressed air coming from the chamber in which the auxiliary arc 12 is struck, opens a valve 71 and is thus also driven against said principal arc. This compressed air cannot drive back the piston 1, the latter being held against movement backwardly by cam 63.

The invention also contemplates the use of a combination of suitable means, herein illustratively valves for successively or simultaneously causing the compressed fluid contained in the chamber in which the auxiliary arc is struck and in the compressor cylinder, respectively, to flow from said chamber and said cylinder against the arc 9. An illustrative embodiment of this feature is shown in Fig. 10.

The circuit-breaker represented in said figure is somewhat analogous to that of Fig. 6. Herein it comprises a pipe 72 which is moved by mechanism which is identical with that of said figure. Said tube forms the rod of a piston 75 which operates within a cylinder 74 mounted upon a suitable support such as an insulator 75. The principal fixed contact 8 is carried by an insulator 45 and is provided with a spring to enable the auxiliary arc to be struck before the principal arc, as has been explained in describing the circuit-breaker of Fig. 6. The principal movable contact 7 is mounted within the entrance of said tube 72. The fixed auxiliary contact 10 is mounted upon the cylinder 74 while the auxiliary movable contact 11 is mounted upon the piston 73. The chamber within which the auxiliary arc 12 is struck is therefore annular in shape. Said chamber communicates with cylinder 74 by means of a valve 76 on said piston 73, which constitutes the air compressor which is thus in communication with the contact 7 through the pipe 72. Upon separation of the contacts this pipe is moved toward the left of said figure. As has been already explained the auxiliary arc 12 is struck prior to the striking of the principal arc 9. The arc 12 increases the pressure of the air within said annular chamber formed by the pipe 72 and said cylinder 74 and thus opens the valve 76 allowing the compressed fluid to escape through the tube 72. The two blasts of fluid for blowing the arc thus flow in parallelism against the arc 9. When the currents which are interrupted are weak, the pressure created within said annular chamber does not suffice to open said valve 76 and the movement of said piston creates a partial vacuum in said chamber. To overcome this objectionable feature a second valve 77 is provided in

the rear wall of said cylinder, through which the space behind the piston in said cylinder is caused to communicate with the outer atmosphere whenever the pressure in said annular chamber does not exceed that required for operating said valve **76**.

In accordance with the invention the apparatus represented in Figs. 5 and 9 may be provided with means for causing a concentric flow of the compressed fluid blasts, as is represented in Fig. 11. The majority of the parts and instrumentalities of the circuit-breaker in Fig. 11 are identical with those of the circuit-breaker of Fig. 5. The only difference resides in the construction and arrangement of the blast nozzle for the principal arc **9**. This nozzle comprises two concentric mouth-pieces **78** and **79**, the former being mounted for sliding movement within its support **80** whenever the pressure produced by the auxiliary arc **12** exceeds that produced by the piston **1**. In such case said mouth-piece **78** is retracted and uncovers the end of the fixed contact **8** which is thus placed in the most favorable position relatively to the neck of said mouth-piece.

Any one of the forms of circuit-breakers above described may be provided with a resistance serving to delay the re-establishment of the tension. Said resistance may be applied either mechanically or pneumatically and will preferably shunt the auxiliary arc and, the casing arising, the principal arc. Fig. 12 illustrates an example of such an arrangement applied to a circuit-breaker the majority of the instrumentalities of which are identical with those of the circuit-breaker shown in Fig. 5. When the intensity of the current (short circuit) to be cut is weak, the interruption of said current is effected without the insertion of said resistance by using only the blast produced by the compressor. When however said intensity becomes considerable the arc of the auxiliary contacts produces a blast and inserts or throws said resistance **81** into operation. The current which remains for the principal contact to cut is therefore only a current the intensity of which has been reduced by said resistance.

A capacity may be substituted for said resistance in all the circuit-breakers of the latter type and said capacity may be rendered operative either mechanically or pneumatically and will preferably shunt the auxiliary arc and the case arising the principal arc.

The compressed air blast produced by the compressor cylinder may not only act simultaneously with that supplied from the chamber in which the auxiliary arc is struck but may also act after the arc has been extinguished. This has the advantage that the space about the contacts is efficiently and thoroughly scoured, any restriking of the arc being thus precluded. This operation takes place automatically in the majority of the apparatus above described, by causing the principal contacts and the auxiliary contacts to move at a suitable regulated speed and by making the compressor plant of suitable dimensions.

Among the many advantages possessed by apparatus embodying the present invention may be mentioned the increase in the rupturing power of the usual circuit breakers which themselves compress the air required for blowing their arcs, as well as the possibility of regulating the intensity of the arc-extinguishing blast proportionally to the intensity of the current to be cut, and the fact that small arcs can be extinguished as well as larger arcs.

BERNARD MARIE HILAIRE PAUL FERNIER.

PUBLISHED
JUNE 15, 1943.
BY A. P. C.

B. M. H. P. FERNIER
ELECTRIC CIRCUIT-BREAKERS WITH COMPRESSED FLUID BLOW OUT
Filed July 29, 1939

Serial No.
287,348
6 Sheets-Sheet 1

Fig. 1

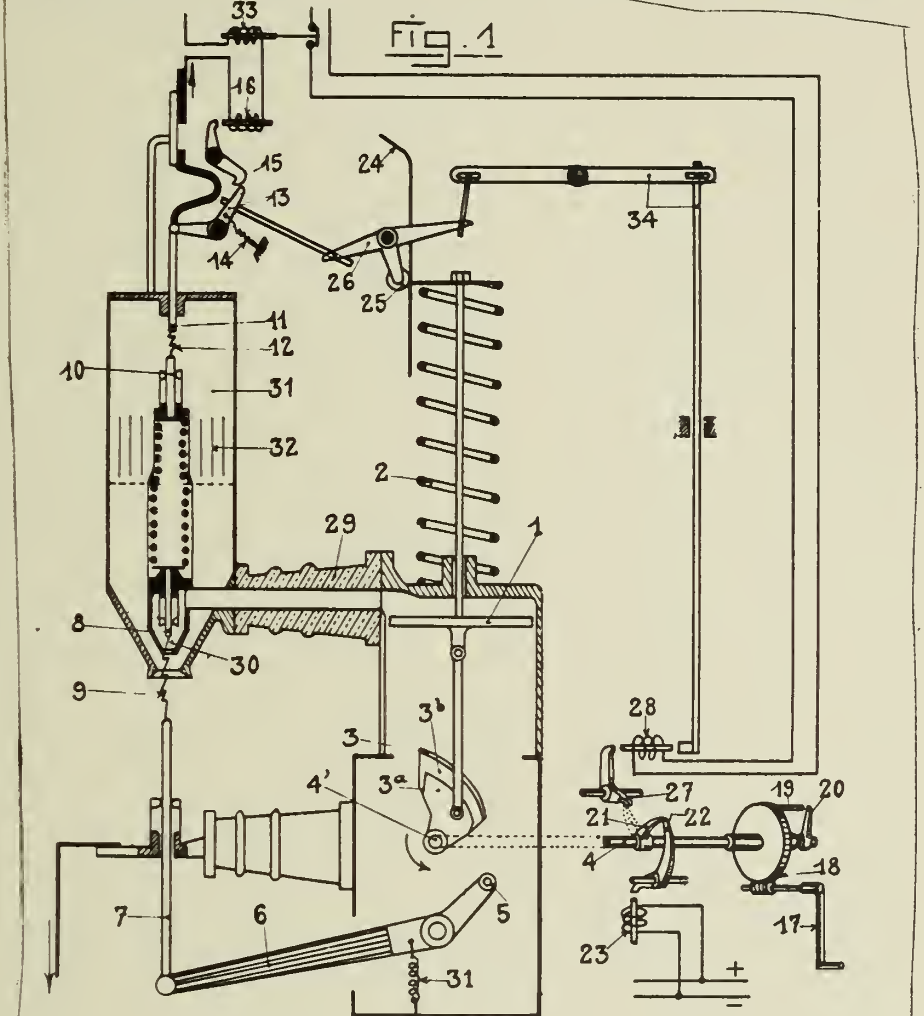
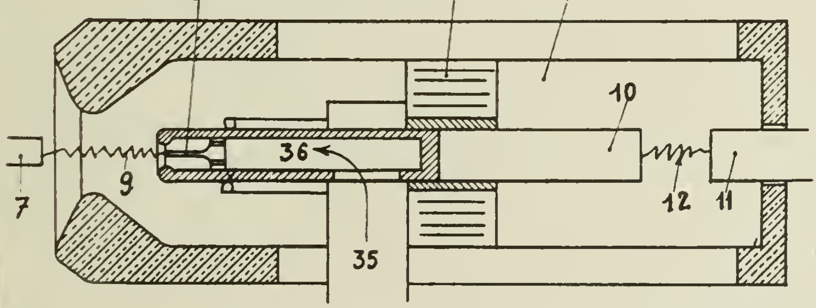


Fig. 2



Inventor:

Bernard, Marie, Hilaire, Paul Fernier

PUBLISHED
JUNE 15, 1943.
BY A. P. C.

B. M. H. P. FERNIER
ELECTRIC CIRCUIT-BREAKERS WITH COMPRESSED
FLUID BLOW OUT
Filed July 29, 1939

Serial No.
287,348
6 Sheets-Sheet 2

Fig. 3

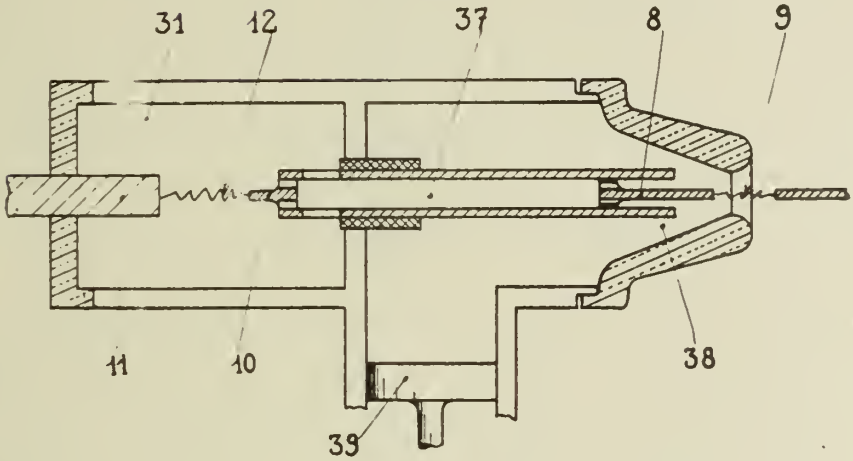
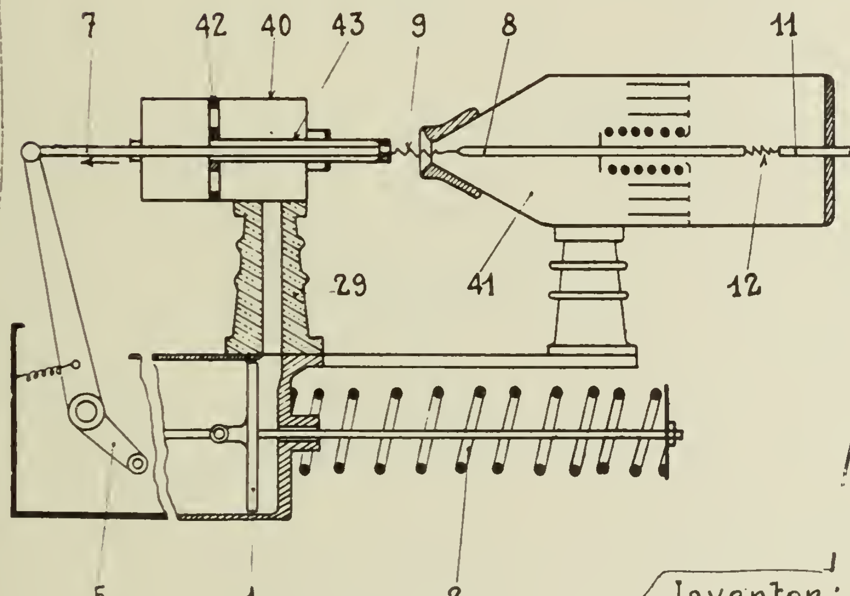


Fig. 4



Inventor:

Bernard, Marie, Hilaire, Paul Fernier

PUBLISHED

JUNE 15, 1943.

BY A. P. C.

B. M. H. P. FERNIER

ELECTRIC CIRCUIT-BREAKERS WITH COMPRESSED FLUID BLOW OUT

Filed July 29, 1939

Serial No. 287,348

6 Sheets-Sheet 3

Fig. 5

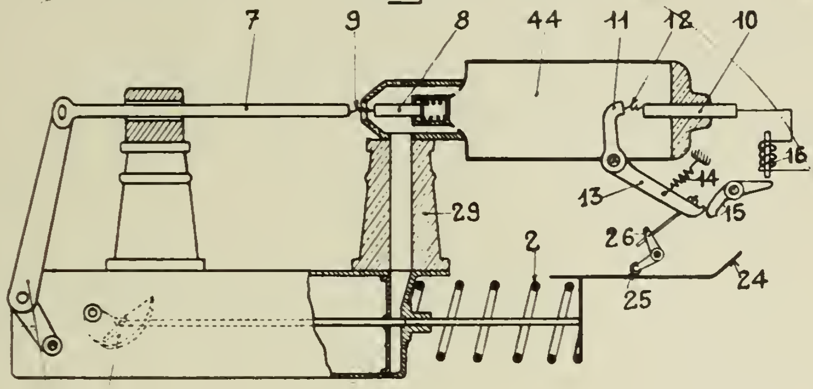
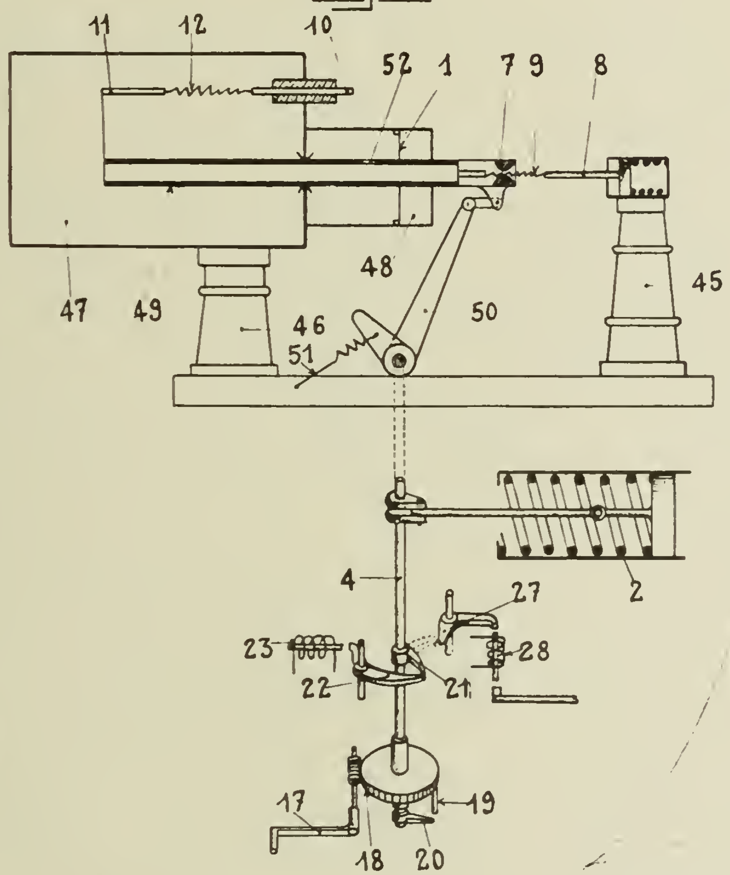


Fig. 6



Inventor:

Bernard, Louis Hilaire, Paul Fernier

PUBLISHED

JUNE 15, 1943.

BY A. P. C.

B. M. H. P. FERNIER
ELECTRIC CIRCUIT-BREAKERS WITH COMPRESSED
FLUID BLOW OUT
Filed July 29, 1939

Serial No.
287,348

6 Sheets-Sheet 4

Fig. 7

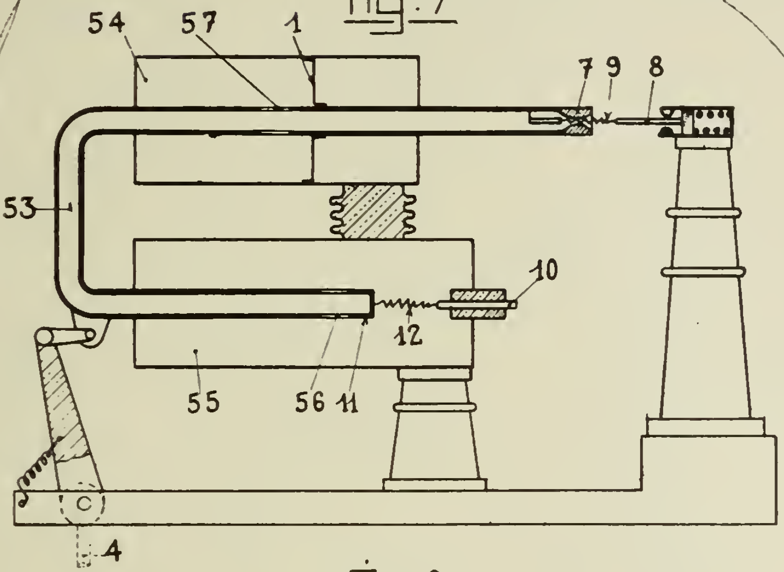
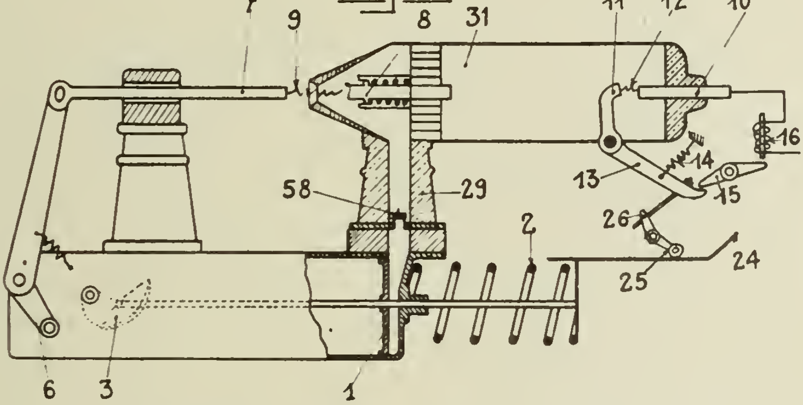


Fig. 8



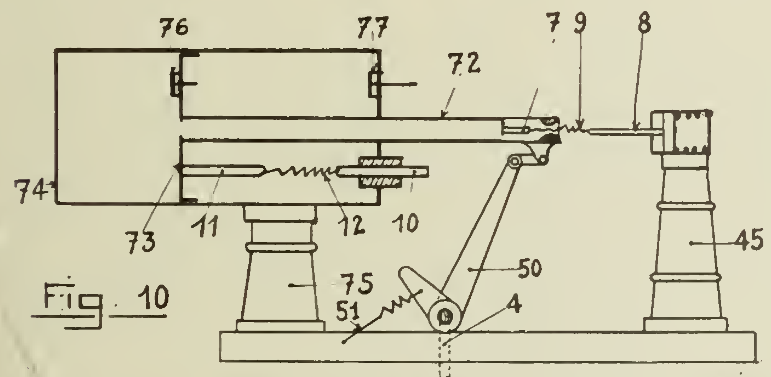


Fig. 10

Inventor:
Bernard, Marie, Hubert, Paul Fernier

PUBLISHED

JUNE 15, 1943.

BY A. P. C.

B. M. H. P. FERNIER
ELECTRIC CIRCUIT-BREAKERS WITH COMPRESSED
FLUID BLOW OUT
Filed July 29, 1939

Serial No.
287,348

6 Sheets-Sheet 5

Fig. 9

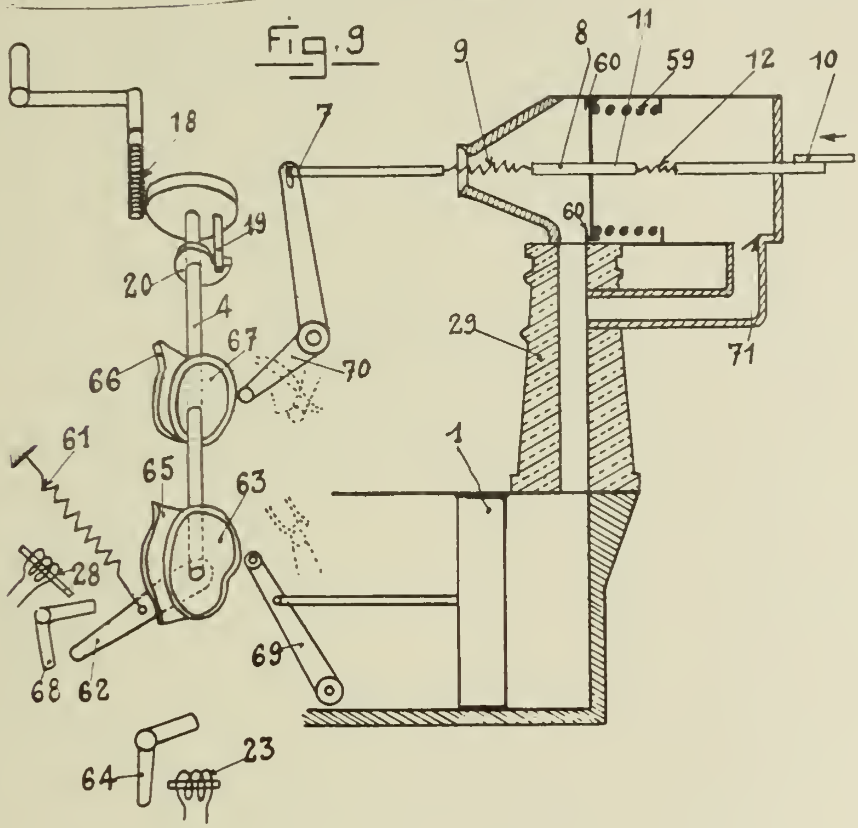
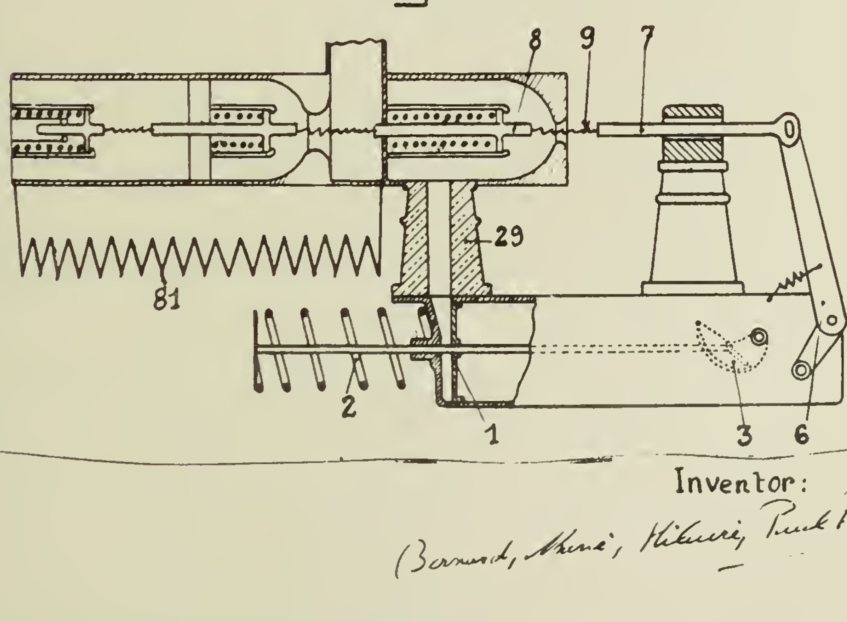


Fig. 12



Inventor:

(Bernard, Marie, Hilaire, Paul Fernier

PUBLISHED

JUNE 15, 1943.

BY A. P. C.

B. M. H. P. FERNIER
ELECTRIC CIRCUIT-BREAKERS WITH COMPRESSED
FLUID BLOW OUT
Filed July 29, 1939

Serial No.
287,348

6 Sheets-Sheet 6

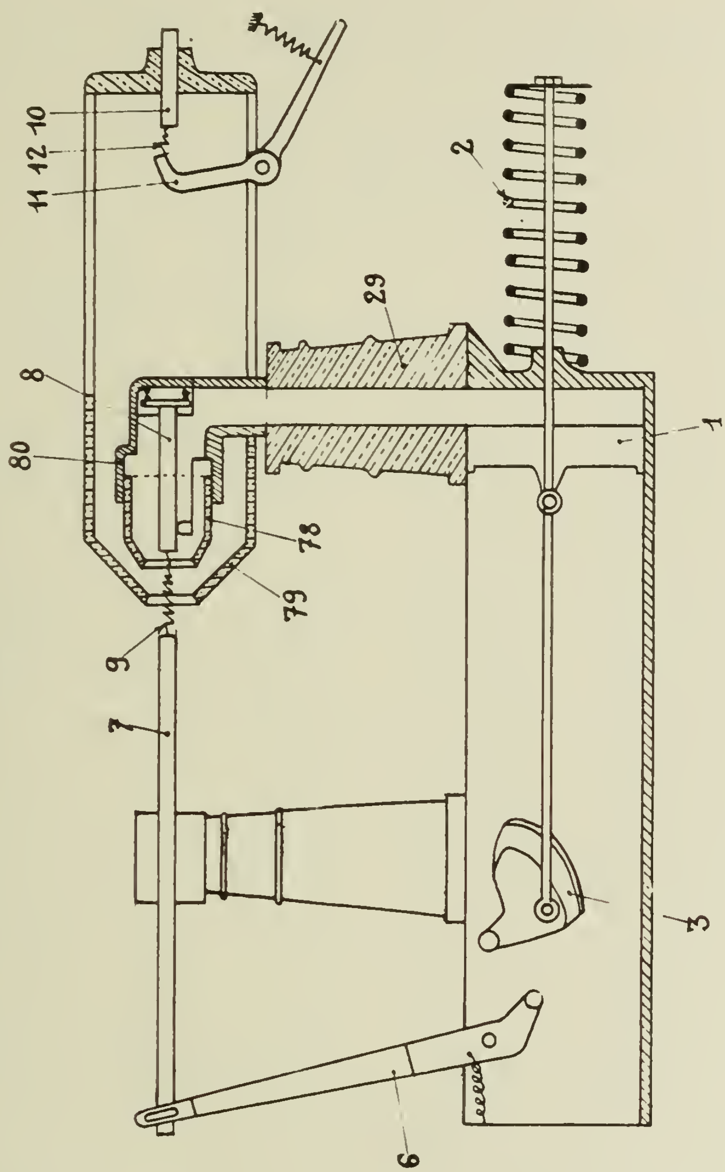


Fig_11

Inventor:

Published June 15, 1943 Serial No. 289,028

ALIEN PROPERTY CUSTODIAN

SHOES AND THE LIKE

Serge Brandel, Villefrancha-sur-Mar, Alpes-Maritimes, and Henri Perrot, Paris, France; vested in the Alien Property Custodian

Application filed August 8, 1939

Our invention relates to shoes, sandals and the like. Its primary object is to provide for a thorough ventilation of the foot.

By way of non-limitative examples, two embodiments of a shoe according to our invention have been shown in the accompanying drawing.

In said drawing.

Fig. 1 is a side view of a first embodiment;

Fig. 2 is a transverse section of the shoe at an intermediate point of the sole and looking towards the heel, and

Fig. 3 is a perspective view of another embodiment.

As shown in Figs. 1 and 2, the shoe comprises a framework **1**, in this case in one piece, made of hollowed-out wood or of moulded plastic material, with which the heel **2** is also integral. The front part of said frame work is hollowed-out in register with the sole of the foot and is composed at that spot of only a border **3** which follows the outer contour of the sole of the foot. On the upper face of said border **3** is fixed the perforated element **4** for resting the foot, which element is in this case formed by plaited straw. On the under face of the border which forms a surface for resting on the ground is fixed a leather covering **5** formed by a strip or by a plurality of superposed strips. The upper part of the shoe may be constructed in any manner and has not been shown.

It will be gathered from the above that we have thus provided a shoe where the sole is provided with apertures extending right through same, the opening on the under face of said sole of the holes that pass through same being effected in a part of the sole which is raised relatively to the points of said sole which bear on the ground in the same cross-section.

A thorough circulation of air through the sole and an excellent ventilation of the foot are thus obtained.

It will be seen further that in this example, all the interstices of the plaited element **4** open into a single common cavity **6** which communicates with the atmosphere, both at the end of the foot and below the arch of the foot. On the other hand, the two sides of the border **3** are provided with holes **7** which open into said cavity **6**. This cavity **6** acts as a common collector for said interstices.

In the embodiment shown in Fig. 3, the framework is similar to the one described above but is covered on the outside with sheets **8** of plastic material and the perforated foot rest element **4*a*** is itself formed by a sheet **9** of plastic material, over the surface of which are distributed perforations **10**.

The framework may also be made of any appropriate material which is moulded, cut or shaped in any manner whatsoever. It may be made for instance of superposed layers of cork and of salpa. A rugged, light framework is thus obtained which is nevertheless fairly flexible.

The perforated element for the sole of the foot may also be formed by wickerwork similar to that of wicker seats, the border formed by said framework acting as the frame of said seats. A bearing element thus formed is very strong, light and inexpensive and enables resting sandals to be chiefly constructed. It may also consist of perforated straps, strips, bands or plates somewhat spaced apart and fixed on said border of the skeleton.

The surface whereby said framework rests on the ground may be covered with leather, sponge rubber, crepe, cork or any other similar material that is generally used for this purpose.

The outer covering of the framework may advantageously be made of lacquered rushes arranged side by side.

Finally a complement in order to enable an automobile to be driven more easily with this type of shoes, consists in a bar or plate carried by the framework below the perforated foot rest element, inside the cavity limited by the border which follows the contour of the sole of the foot, said bar or plate being separate or formed integral with the framework.

SERGE BRANDEL.
HENRI PERROT.

PUBLISHED
JUNE 15, 1943.
BY A. P. C.

S. BRANDEL ET AL
SHOES AND THE LIKE
Filed Aug. 8, 1939

Serial No.
289,028

Fig. 1

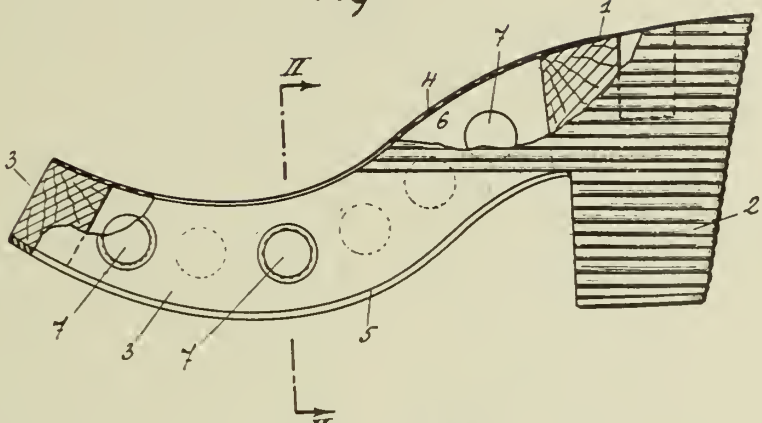


Fig. 2

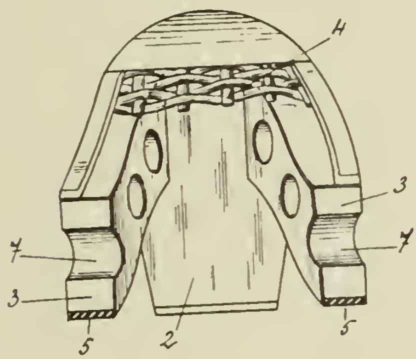
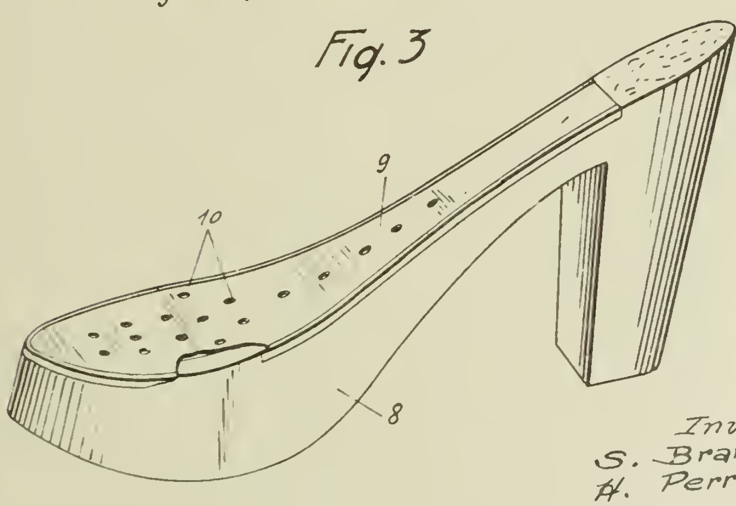


Fig. 3



Inventors,
S. Brandel
H. Perrot

By: Glascock Downing & Seebold
Attys.

ALIEN PROPERTY CUSTODIAN

HYDRAULIC POWER TRANSMISSION APPARATUS

Piero Mariano Salerni, Cox Green, Berkshire, England; vested in the Alien Property Custodian

Application filed August 12, 1939

This invention relates to hydraulic power transmission apparatus of the kind in which a rotary impeller or driving member having ducts between vanes drives by means of a liquid circulating in a closed circuit a turbine or driven member having ducts the inlets whereof are disposed in the said circuit at a radius (i. e. at a radial distance from the axis of rotation) larger than the radius at which their outlets are disposed, said ducts being formed between vanes which are not withdrawable from the liquid (and which are hereinafter referred to as "fixed vanes"), and which comprises a reaction member, and wherein the torque imparted by hydraulic means to the turbine in the forwards direction (i. e. in the direction of rotation of the impeller) is or can be substantially greater than that imparted to the impeller whereby transmission of power may be effected by hydraulic means at a torque ratio substantially greater than the ratio of 1 to 1 independently of any mechanical change speed gearing.

According to this invention there is provided a hydraulic power transmission apparatus of the kind specified in which the impeller has at least a substantial part of its ducts non-divergent and such non-divergence extends up to or nearly up to the outlet of the impeller and in which the turbine has bulbous members. By bulbous members are meant members which present to the impinging fluid bulbous heads so constructed as to reduce the eddying or turbulence due to the impinging of the fluid, from the various directions that occur in practice, upon the inlet ends of the vanes. Preferably the bulbous members are constructed and disposed so as to provide convergent passages between them so as to reduce any eddying or turbulence in the fluid passing between them.

An increase in efficiency is obtained by constructing the impeller so that at least a substantial part of its ducts is non-divergent, i. e. throughout that part any normal cross-section thereof can be superimposed upon every normal cross-section thereof which is more remote than itself from the outlet without overlapping the same. The greater the length of the non-divergent part of each duct the higher will be the efficiency and the length of such part must be substantial i. e. it must be sufficiently long so as to increase the efficiency of the apparatus to a substantial extent. Such an increase in efficiency is caused by the reduction, due to non-divergence, in the eddying and turbulence of the liquid passing through and emerging from such non-divergent part. Such non-divergent part according to the invention must extend up to the outlet or nearly up to the outlet i. e. so near to the outlet that the liquid emerging from the impeller has its turbulence reduced by such non-divergence. A further increase in efficiency is caused by the turbine having at the inlets of its ducts bulbous members so constructed and disposed as to reduce eddying and turbulence. If the length of such non-divergent part and the decrease in its cross-sectional area throughout its length is sufficient, then the liquid emerging from the impeller will have a stable flow i. e. it will be free from eddying and turbulence or sufficiently free not substantially to reduce efficiency, even under conditions when the apparatus is transmitting at ratios of greater than 1 to 1 and with at least 25% of the maximum power which the engine is designed to give under ordinary conditions.

According therefore to another aspect of this invention there is provided a hydraulic power transmission apparatus of the kind specified in which the ducts of the impeller are so constructed that the fluid emerging therefrom has a stable flow under the conditions specified above, and in which the turbine has at the inlets of its ducts bulbous members.

According to further features of the invention the impeller and also the reaction member have at the inlets of their ducts bulbous members constructed and disposed so as to reduce eddying and turbulence.

Preferably all of the aforesaid bulbous members are constructed and disposed so as both to reduce any eddying and turbulence due to the impingement thereon of the fluid from the various directions which will occur in practice and also so as to provide convergent passages between adjacent members further to reduce any eddying and turbulence in the fluid passing between them.

Preferably the impeller has its outlet in the outer half of the circuit and the ducts of the impeller are made non-divergent from a point at or near the inlet up to the outlet. Preferably the cross-sectional area is progressively reduced throughout such length.

The cross-sectional area may be made to decrease in the case of a tetragonal duct either by causing both pairs of opposite walls to converge or by keeping one pair parallel and causing the other pair to converge. If the liquid used has a high viscosity, e. g. as in the case of common engine lubricating oil, if one pair of opposite walls has a convergence of 5° while the other pair remains parallel, a substantial advantage is obtained. Up to a limit (which is at least 15°) the

greater the degree of convergence the better will be the result.

The construction of the apparatus itself imposes limits to the possible amount by which the cross-sectional area can be reduced towards the outlet of the impeller. Thus the outlet must not be unduly constricted as otherwise the liquid will not be able to circulate sufficiently freely to transmit power efficiently. Moreover, the permissible largeness of the inlet of the impeller is limited by considerations of the design of the circuit, since there must not be inordinate discrepancies in size between the dimensions of the channel through which the liquid is delivered to the impeller and the inlet of the impeller.

In the preferred construction the ducts have their outlets at the part of the circuit furthest away from the axis of rotation, so that the liquid issues therefrom in a direction having no radial component. In the preferred construction the ducts extend throughout practically the full radial dimension of the circuit and are curved also towards the inlet. The radius of the outside curve preferably at no point exceeds about twice the radius of the inner curve as otherwise there might be a tendency to eddying and turbulence from this cause. This requirement also, therefore, imposes a limit on the permissible largeness of the inlet.

The reduction of cross-sectional area towards the outlet is preferably as great as possible consistent with the above considerations.

Of the non-divergent part of each duct that portion which lies nearer the inlet is preferably made non-divergent by progressively thickening the vanes of the impeller (i. e. the parts forming the walls separating a duct from adjoining ducts) in the direction towards the outlet. The vanes can be made integral with the impeller but it is convenient to make them separately and to assemble them upon the body of the impeller. Preferably the cross-sectional area is simultaneously progressively reduced and preferably this is accomplished by causing the remaining walls of the duct to converge.

It is preferred to form the outlet of each duct in such a manner that the stream issuing from a duct becomes merged gradually with those issuing from the adjoining ducts without objectionable eddying or turbulence. In order to achieve this the thickness of the vanes must be progressively decreased towards the outlet. This can be accomplished, while maintaining non-divergence, by turning the vanes as they approach the outlet. The turn should be backwards relative to the direction of rotation. Preferably this backwards turn takes place only in that portion of each duct of the impeller which lies nearer to the outlet and preferably in the outer half of the circuit, and preferably in that portion the turn is sufficient to cause the walls constituted by the vanes to converge. Preferably the vanes are radially disposed elsewhere. It will be understood that the extent to which the vanes are turned backwards must not be so great that power is no longer efficiently transmitted (the optimum angle to which the vanes are turned relative to the direction of rotation usually lies between 30° and 60°) and therefore if the vanes are turned backwardly much before they approach the outlet of the ducts, since the thickness of the vanes can only be got rid of without divergence by further backward turning, the opportunity for so doing is correspondingly reduced.

It is preferred that the turbine should have ducts which have a backward curvature in a part commencing at or near their inlets (i. e. are curved so as to deflect the liquid as it flows through this part in a direction having a component relative to the turbine opposite to the direction of rotation of the impeller) and thereafter have a general curvature opposite to such first mentioned curvature.

Preferably the whole of this backward curvature should take place as near as practicable to the inlet of the turbine. It has been found in practice that a duct the direction of which at the inlet of the turbine is approximately parallel to a plane containing the axis of rotation and the direction of which at the end of the backwardly curved part remote from such inlet is at an angle of about 60° to such a plane is satisfactory. It will be obvious that the part of the duct curved in this manner must be of sufficient length to enable the liquid to be turned backwards effectively without narrowing the ducts excessively.

From the point at which the backwards curvature terminates up to or nearly up to the outlet, the duct has a general curvature in a direction opposite to the said backwards curvature, i. e. this latter part of the duct, regarded as a whole, is oppositely curved. Preferably the whole of this latter part is oppositely curved, and preferably the curvature is smooth and such as to conform to what would be the natural path of the flow of the liquid after leaving the backwardly curved part, when the turbine is stationary, if the liquid were unrestrained by vanes in this part of the turbine, i. e. if the part of the vanes forming this part of the ducts were not there.

When the turbine is stationary, i. e. before it has begun to move angularly, the reaction due to the deflection of the liquid backwards, as it flows through the backwardly curved parts of the ducts, tends to rotate the turbine.

When the turbine rotates, power is transmitted also by the liquid being forced from the periphery of the turbine towards the axis. For the purpose of transmission by this method, it is desirable that the inlet and outlet of the ducts formed between the vanes shall be separated by as great a radial distance as practicable. The ducts must accordingly extend throughout a substantial radial height and preferably throughout almost the full radial height of the circuit.

The ducts may be formed between vanes which are continuous from the inlet of the turbine to the outlet. But the vanes need not be continuous and the ducts may be formed between successive annular series of vanes, which may be staggered or not, provided that there is not such a gap as will result in undue shock and loss of efficiency. Preferably additional relatively short backwardly curved vanes are provided at or near to the inlet.

In a modified construction, the said ducts are preceded by one or more sets of auxiliary ducts (also formed between fixed vanes) which are backwardly curved and which are separated from the said ducts and from each other by spaces adapted to receive reaction vanes.

A reaction member has reaction vanes so constructed and arranged at such an angle to the direction of the liquid impinging upon them that under certain conditions of operation (e. g. when the turbine is stationary, and it is desired to produce an increased torque for the purpose of starting) these impart to the liquid a component of velocity in a forwards direction (i. e. the same direction as the direction of rotation of the

impeller). Under such conditions the reaction vanes are operative and tend to be driven by the liquid in a backwards direction and must be restrained against such tendency in order to deflect the liquid in a forwards direction. It is preferable that the ducts of the impeller, turbine and reaction member and the bulbous members should be so constructed that the fluid has a stable flow throughout the circuit under the conditions specified.

As the turbine begins to rotate and the difference between the speeds of the turbine and of the impeller is reduced this tendency decreases and ultimately the reaction vanes are driven by the liquid in a forwards direction and are then inoperative. When, however, the reaction vanes are driven by the liquid in a forwards direction, their angular disposition tends to cause them to rotate at a slower speed than that of the turbine. If the reaction vanes rotate at a substantially different speed from that of the turbine this adversely affects the efficiency.

In order to reduce this loss of efficiency, it is preferable that the reaction member should be capable of rotation in a forwards direction, and should be so constructed that it, or if it has more than one reaction element then at least one such element, should have the average radial distance from the axis of rotation of the middle points of the inlets between its vanes slightly greater than the average radial distance from such axis of the middle points of the corresponding outlets.

In order to provide a large starting torque and also the possibility of obtaining a torque considerably greater than 1 to 1 over a wide range of speeds, it has been found necessary to employ at least two reaction elements, each having a set of reaction vanes, one of which precedes and the other of which follows a set of turbine vanes in the circuit. If both sets of reaction vanes, when they become inoperative, rotate in a forwards direction at a substantially different speed from that of the turbine, the efficiency will be seriously impaired.

It is therefore preferable that there should be provided at least two reaction elements between which is interposed at least one set of turbine vanes, which reaction elements are capable of rotation relatively to each other and of which at least one is such that the average radial distance, from the axis of rotation, of the middle points of the inlets between its vanes is slightly greater than the average radial distance from such axis of the middle points of the corresponding outlets.

The said difference of average radial distance must be slight, i. e. such that when the reaction vanes are rotating in a forwards direction the difference between the speed at which the liquid drives or tends to drive the said reaction vanes and the speed of the turbine is less than it would be if the average radial distances from the axis of rotation of the middle points of the said inlets and outlets were the same. Preferably the said difference of average radial distances is such that when the apparatus is transmitting the maximum available power at a torque ratio of 1 to 1, the said reaction vanes are driven or tend to be driven in a forwards direction by the liquid substantially at the same speed of rotation as the turbine. If the said difference of radial distance is too large, the reaction member will be driven considerably faster than the turbine with consequent loss of efficiency.

Preferably each reaction element is constructed as aforesaid.

By this embodiment of the invention it is possible to prevent the said loss of efficiency without the necessity of introducing any mechanical complications such as are involved if a lock is introduced between the turbine and reaction elements. Such a lock, apart from the additional mechanism involved, is objectionable for other reasons e. g. when in operation it results in the formation of a compound turbine part of whose vanes are disposed at an angle in a forwards direction, involving undue sinuosity of the path of the liquid and consequent loss of efficiency.

The invention will now be described by way of example with reference to the accompanying drawings which show certain preferred embodiments of the invention.

Figure 1 is a cross-section of an embodiment of the invention through the axis of rotation which shows the liquid circuit.

Figures 2, 3, 4 and 5 are cross-sections of a duct on the lines A—A, B—B, C—C, and D—D respectively of Figure 1.

Figure 6 shows the cross-sectional areas of the duct sections of Figures 2, 3, 4 and 5 superimposed.

Figure 7 is a development of a vane on the line X—Y of Figure 1.

Figure 8 is a development of one duct on the line X—Y of Figure 1.

Figures 9, 10, 11, 12 and 13 show the cross-sectional area of a duct on the lines *d*—*d*, *c*—*c*, *b*—*b*, *a*—*a* and *e*—*e* of Figure 8 which correspond to the lines D—D, C—C, B—B, A—A, and the outlet, respectively, of Figure 1.

Figure 14 shows the cross-sectional areas of the duct sections of Figures 9, 10, 11, 12 and 13 superimposed.

Figure 15 is a development of a vane having a bulbous member as an extension at the inlet.

Figure 16 is a development of a duct between the two vanes as shown in Figure 15.

Figure 17 is a development in one plane of a turbine made according to this invention.

Figure 17*a* is a variant of the arrangement shown in Figure 17.

Figure 18 is a perspective view of parts of the impeller and of the turbine seen from a direction at right angles to the axis of rotation.

Figure 19 is a perspective view of another part of the turbine seen from a direction parallel to the axis.

Figure 20 is a cross-section of a further embodiment of the invention through the axis of rotation which shows the liquid circuit.

Figure 21 is a part section view, part perspective view on the line A—A of Figure 20.

Figure 22 is a similar view to that shown in Figure 21 but on the line B—B of Figure 20. It will be noted that the views of Figures 21 and 22 overlap.

Figure 23 is a perspective view of the reaction member looking down on the top of Figure 20, parts being broken away to show the vanes.

Figure 24 shows a modification of Figure 20.

In Figure 1, **1** is the impeller, **2** is the turbine and **3** is the reaction member. When the impeller **1** is rotated by any prime mover, liquid flows therein by centrifugal action from the inlet **4** thereof to the outlet **5** thereof whence it is discharged into the inlet **6** of the turbine through which it flows in a radially inwards direction imparting rotational movement thereto. The outlet is preferably situated in the outer half

of the circuit, i. e. on that side of the line B—B which is remote from the axis of rotation, and in the embodiment shown is situated at the major radius of the circuit.

The outer and inner walls of the ducts in the impeller are formed by the members **9** and **10** and the side walls are formed by the vanes **11**, **12**. **7** and **8** are rivets securing these vanes to the members **9** and **10**.

At the inlet (Figure 5) the vanes are thin and the cross-sectional area of the ducts of the impeller is at a maximum. The thickness of the vanes is thereafter progressively increased as shown in Figures 4, 3 and 2 so as to maintain the walls of the ducts formed by the vanes **11** and **12** non-divergent, notwithstanding that the vanes are extending radially outwards from the axis of rotation. The walls **9** and **10** are progressively brought closer together to reduce the cross-sectional area, the height of the vanes being accordingly reduced. Figure 6 shows the successive cross-sections of the duct superimposed and it will be seen that the side walls remain the same distance apart while the top and bottom walls are converging. The vanes have been thickened as shown in Figure 7 from the point **13** at the inlet to the point **14** corresponding to the line A—A of Figure 1.

Thereafter from the point **14**, the vane is turned backwards towards the outlet so that the thickness of the vane may be progressively reduced while the duct remains non-divergent as shown in Figure 8. In the embodiment illustrated, in the latter part of each duct, i. e. from the line *a*—*a* (Figure 8) to the outlet, the sides of the duct constituted by the vanes converge (the backwards turn being sufficient for this purpose) and the walls of the duct formed by the members **9** and **10** are maintained parallel.

The vanes are progressively rounded as shown at **15** (Figure 4), **16** (Figure 3) and **17** (Figure 2) in order that the duct which is tetragonal at the inlet and the outlet may not have sharp corners throughout the greater part of its length. This accounts for the D-shaped cross-section of the outlet shown in Figure 13 on the line *e*—*e* of Figure 8. One side of the outlet is constituted by a part of a vane which is some distance from the tip and is still somewhat rounded, while the other side is constituted by the tip of a vane which has there ceased to be rounded.

The radius of curvature of the part **9** should not be more than about twice the radius of curvature of the part **10**.

In order to avoid or decrease losses due to shock at the inlet the latter is preferably disposed at as little a distance as possible from the discharge outlet of the member through which the liquid has passed previously to entering the impeller. Bulbous members **19** (Figures 7, 8, 15 and 16) are placed at or near the inlet in fixed relation to the vanes of the impeller being as shown so constructed and disposed as to reduce any eddying and turbulence due to the impingement thereon of the fluid from the various directions which will occur in practice. These members also rapidly constrict the space through which the liquid must pass before entering the inlet, i. e. from **20** to **21**, thus providing a convergent passage which will further reduce eddying and turbulence. Thereafter a gradual expansion of such space takes place up to the inlet, which must, as pointed out previously, be relatively large in order to permit a progressive reduction of cross-sectional area throughout each duct of the impeller from the inlet **4** to the outlet **5**. Although the said gradual expansion up to the inlet tends to reduce some eddying and turbulence, the total amount thereof is smaller than that which would result from shock in the absence of the members **19** and of the initial constriction caused by the bulbous ends thereof as stated above.

The preferred construction and disposition of the bulbous members is shown in Figures 15 and 16 where the members **19** are formed as integral extensions of the vanes, but they may be offset as shown in Figures 7 and 8.

Referring to Figure 17—**21**, **26**, **27** indicate one of the fixed vanes having a bulbous head **21** near the inlet of the duct **23** which will operate in a similar manner to that described above with reference to the bulbous members at the inlet of the impeller. **24** is the outlet of the duct **23**, which outlet is situated nearer the axis **28** of the turbine than the inlet. **25**, **25** are short fixed vanes placed between the bulbous heads **21**, **21** of the full length vanes, which vanes are of similar shape to the part **21** of the full length vanes **21**, **26**, **27**. In the part **22** of the duct **23** which part is near the inlet (and in the embodiment shown is divided into two by the vanes **25**, **25**) the duct is curved backwards, the direction of rotation being shown by the arrow *r*. The change of direction imparted to the liquid in the part **22** is the angle between the lines *x* and *y* which in the example shown is about 60°. Thereafter the duct is oppositely curved in such a manner as to conform to what would be the direction of flow of the liquid in this part of the turbine before the turbine has begun to move if the part of each vane from **26** to **27** were absent.

In the modified construction shown in Figure **17***a*, which may be more convenient to manufacture, the ducts are constituted by two series of vanes, viz. an outer series **31**, **31** and an inner series **32**, **32**. The outer series **31**, **31** which are situated near the inlet have a backwards curvature and the inner series **32**, **32** which extend to the outlet are oppositely curved. The radial gap between the series **31**, **31** and the series **32**, **32** is sufficiently small to avoid undue shock.

Referring to Figure 1 it will be observed that the ducts of the turbine **2** extend throughout almost the full radial height of the circuit.

Referring to Figures 18 and 19, **40** is the outer casing of the apparatus, **41**, **41** are the delivery ends of the vanes of the impeller, and **42**, **42**[1] and **43** are vanes of the turbine. In the embodiment shown in these figures the vanes **42**[1] extend from the inlet of the turbine to the outlet, while the vanes **42** are somewhat shorter but otherwise similar. The vanes **43** are still shorter. **44**, **44** are the ducts formed between the vanes **42**[1], which ducts by reason of the curvature of these vanes are backwardly curved near the inlet and thereafter oppositely curved up to the outlet. The vanes **43** are similar to the vanes **25** of Figure 17 and the vanes **42**[1] to the vanes **21**, **26**, **27** of Figure 17.

Referring to Figure 20, which shows a modification, **1** is the impeller, the construction of which is the same as in Figures 1–16, but the turbine now consists of two parts **2**, **2**[1] and the reaction member **3** also of two parts **3***a* and **3***b*, the part **3***a* of the reaction member being inserted between the parts **2**, **2**[1] of the turbine whilst the other part **3***b* is located between the outlet of the turbine and the inlet of the impeller. Referring to Figures 21 and 22, Figure

21 shows the vanes of the turbine part 2^1 (Figure 20) and Figure 22 shows the inlet ends of these vanes as well as a set of vanes **56** on the turbine part **2**. **50, 50** are vanes which extend from the inlet to the outlet and which are shaped to form between them the ducts **52** which are backwardly curved near the inlet and thereafter oppositely curved as in the previous construction. **51** indicate short vanes similar to the vanes **25** in Figure 17. As shown in Figure 22, the turbine has a set of auxiliary ducts **55**, formed between the auxiliary vanes **56**, preferably integral with the turbine part **2**, which ducts **55** and vanes **56** precede the main ducts **52** and vanes **50** that extend throughout almost the full radial height of the circuit. The ducts **55** and the vanes **56** of the auxiliary set are backwardly curved and are situated at a part of the circuit most remote from the axis. The reaction due to the backwards curvature of the auxiliary set of ducts assists to rotate the turbine. The vanes of the part *3a* (Figure 20) of the reaction member are interposed in the space **57** between the auxiliary set of turbine vanes **56** and the main turbine vanes **50, 51** and these reaction vanes are so curved as to deflect the flow of the liquid forwardly, i. e. to the same direction as the direction of rotation and consequently the backwards curvature of the part near the inlet of the ducts **52** operates as before to tend to rotate the turbine, notwithstanding the presence of the preceding set of backwardly curved auxiliary ducts **55**. One or more additional preceding sets of ducts and vanes can be similarly added, with reaction members between each set, to increase the starting effort if this is desired.

Referring to Figure 20, the liquid enters between the turbine vanes **2** by the inlets *2a* and leaves by the outlets *2b*, the turbine vanes being so disposed that, as the liquid flows through, the turbine tends to rotate forwardly and the direction of flow of the liquid is turned backwardly. The liquid then enters between the reaction vanes *3a* by the inlets **64**, the reaction vanes (as shown at **60, 60** Figure 23) being so disposed as to change the direction of flow of the liquid again to a forwards direction. The direction of rotation of the impeller is shown by the arrow **62**, Figure 23. The reaction elements when operative are prevented from rotation in a backwards direction by any suitable means (not shown). The liquid leaves the reaction vanes *3a* by the outlets **65** and enters between the turbine vanes 2^1 by the inlets *2c*, and leaves by the outlets *2d* and enters between the reaction vanes *3b* (also shown at **61, 61** Figure 23) by the inlets **46** and leaves by the outlets **67**, whence it passes into the inlets **68** of the impeller **1**.

The turbine vanes 2^1 and the reaction vanes *3b* operate in a manner similar to that of the turbine and reaction vanes **2** and *3a* respectively.

In the embodiment of the invention illustrated, the average radial distance of the middle points of the inlets **64, 66** from the axis of rotation, indicated by XX, is slightly greater than that of the middle points of the corresponding outlets **65, 67** respectively.

The difference in the average radial distance from the said axis of the middle points of the inlets **64** and **66** and of the corresponding outlets **65** and **67**, respectively, preferably is such that, when the apparatus is transmitting the maximum available power at a torque ratio of 1 to 1, the reaction vanes are driven or tend to be driven by the liquid in a forwards direction substantially at the same speed of rotation as the turbine.

In the embodiment illustrated in Figure 24 the reaction element 3^a is rotatably mounted in such a manner that it can rotate in a forwards direction independently of the reaction element 3^b but is prevented by the ratchet and pawl device **63** from relative rotation in a backwards direction. The reaction element 3^b is prevented from rotation in a backwards direction relative to the fixed casing by any suitable means (not shown).

The vanes of the reaction member are formed with bulbous members at the inlets as indicated for example in Figure 1 and in Figure 23 of the accompanying drawings which will operate in a similar manner to those described with reference to the bulbous members at the inlet of the impeller.

The arrangement of the vanes and the relative sizes of the various parts shown in the figures have been found in practice to be satisfactory in the application of the invention to an automobile.

PIERO MARIANO SALERNI.

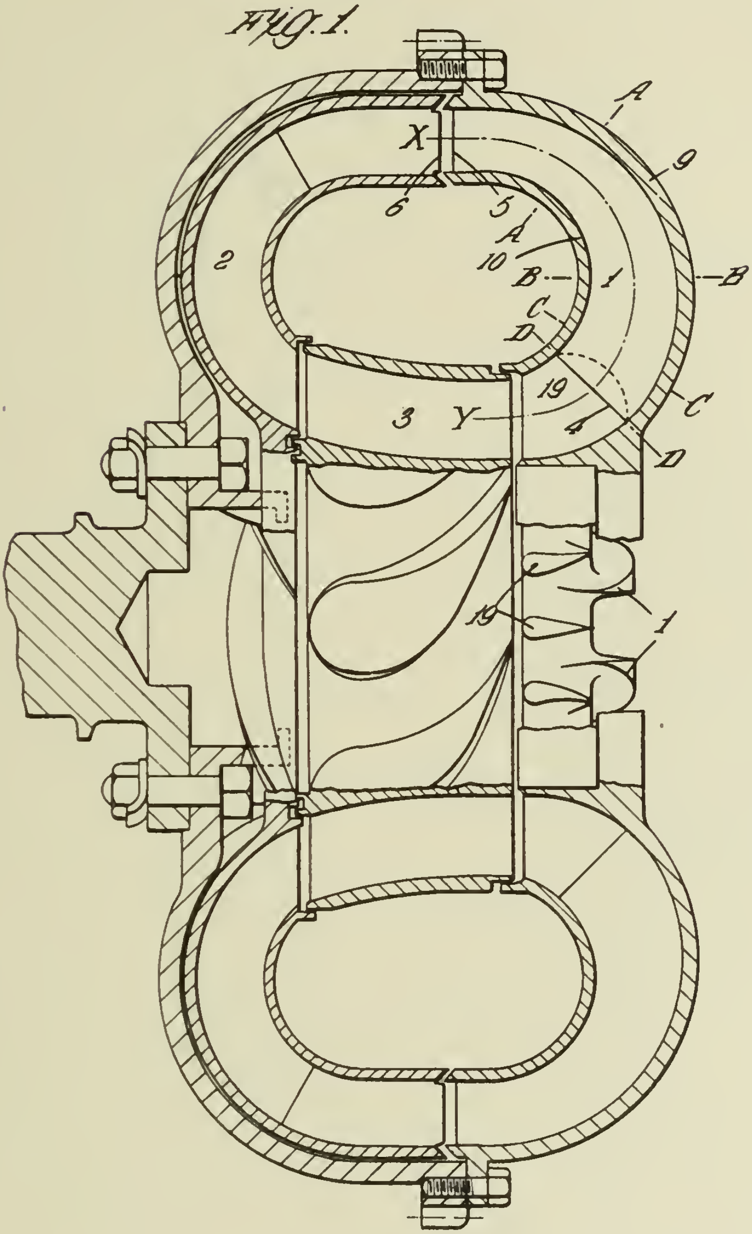
[illegible]

PUBLISHED
JUNE 15, 1943.
BY A. P. C.

P. M. SALERNI
HYDRAULIC POWER TRANSMISSION APPARATUS
Filed Aug. 12, 1939

Serial No.
289,763
7 Sheets-Sheet 1

Fig. 1.



INVENTOR:
PIERO MARIANO SALERNI
BY: Haseltine, Lake & Co.
ATTORNEYS

PUBLISHED
JUNE 15, 1943.
BY A. P. C.

P. M. SALERNI
HYDRAULIC POWER TRANSMISSION APPARATUS
Filed Aug. 12, 1939

Serial No.
289,763
7 Sheets-Sheet 2

Fig. 2.

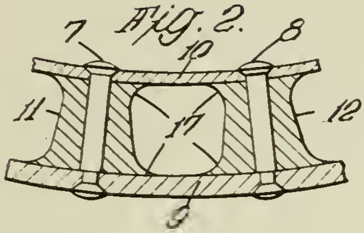


Fig. 3.

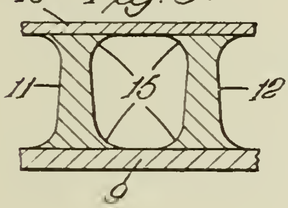


Fig. 4.

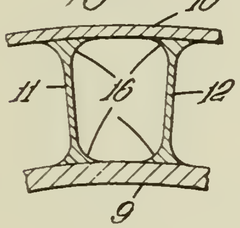


Fig. 5.

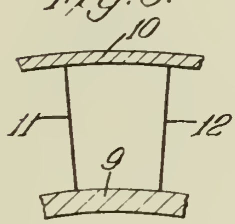
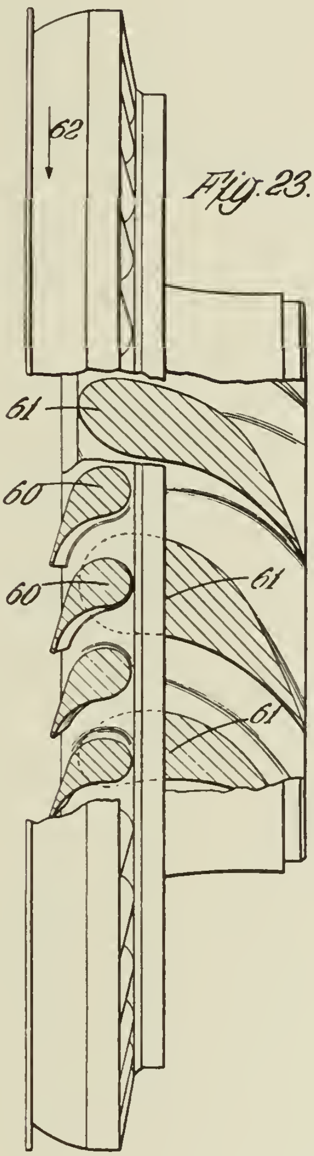


Fig. 23.



INVENTOR
PIERO MARIANO SALERNI
BY Haseltine, Lake & Co.
ATTORNEYS

PUBLISHED
JUNE 15, 1943.
BY A. P. C.

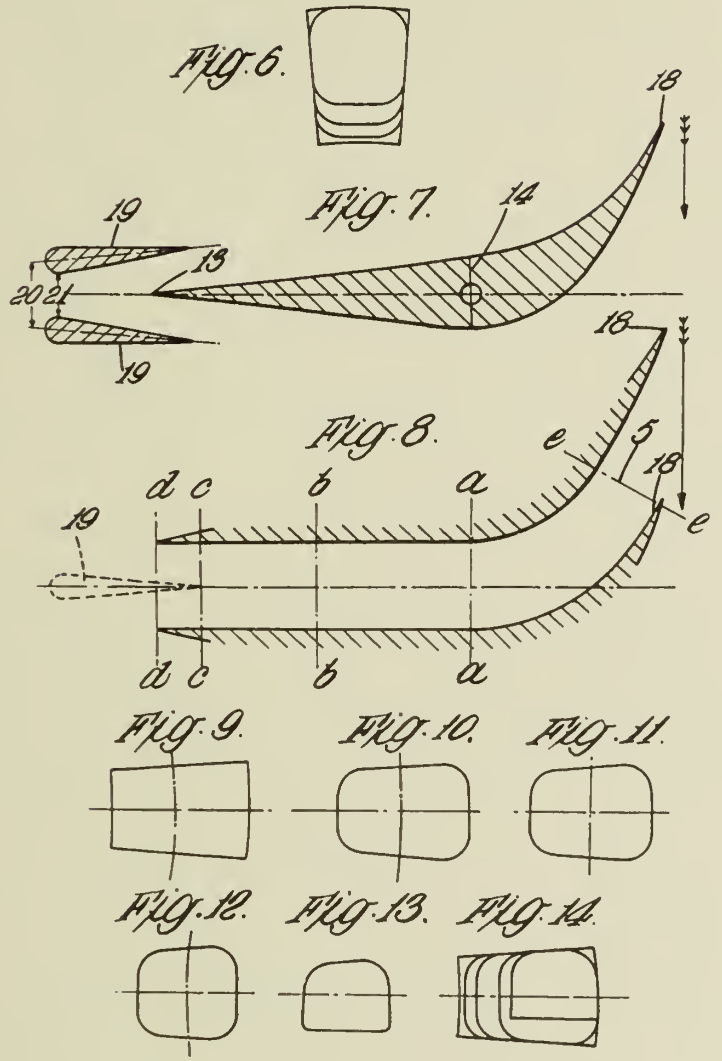
P. M. SALERNI

HYDRAULIC POWER TRANSMISSION APPARATUS

Filed Aug. 12, 1939

Serial No.
289,763

7 Sheets-Sheet 3



INVENTOR:
PIERO MARIANO SALERNI
BY: Haseltine, Lake & Co.
ATTORNEYS

PUBLISHED
JUNE 15, 1943.
BY A. P. C.

P. M. SALERNI

HYDRAULIC POWER TRANSMISSION APPARATUS

Filed Aug. 12, 1939

Serial No.
289,763

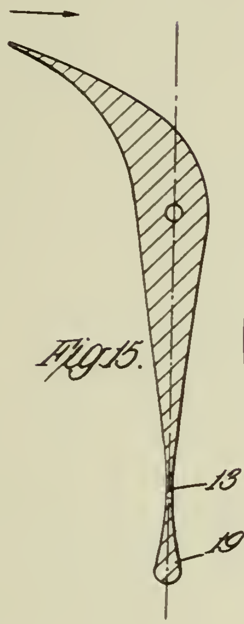


Fig.15.

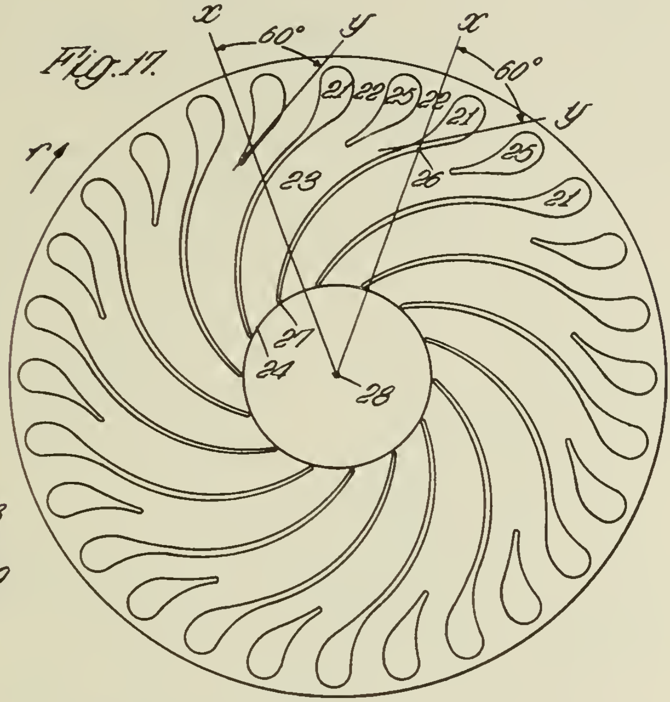


Fig.17.

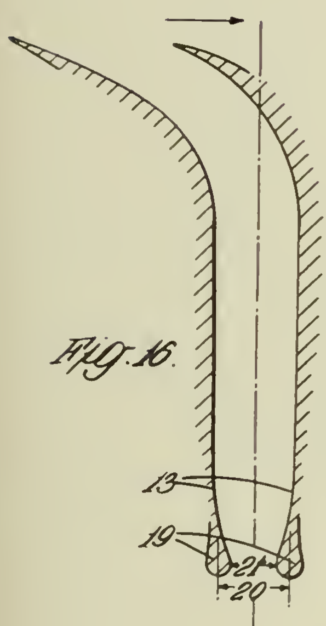


Fig.16.

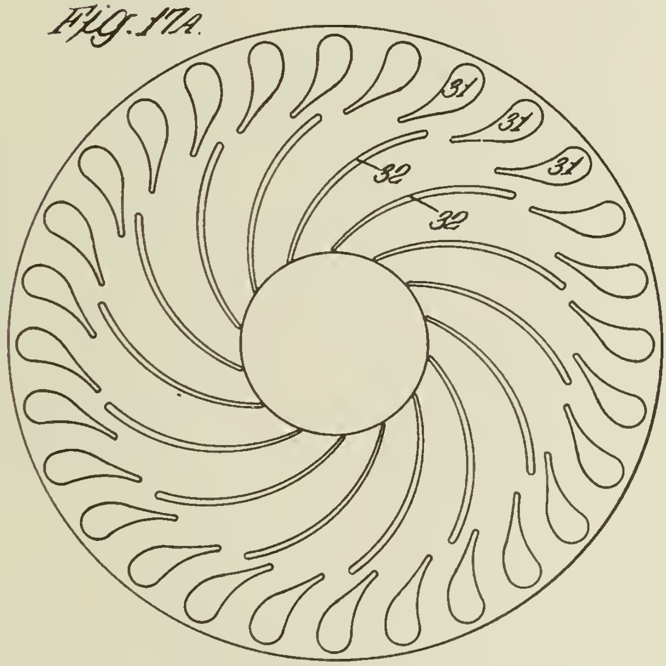


Fig.17A.

INVENTOR.
PIERO MARIANO SALERNI
BY Haseltine, Lake & Co.
ATTORNEYS

PUBLISHED
JUNE 15, 1943.
BY A. P. C.

P. M. SALERNI
HYDRAULIC POWER TRANSMISSION APPARATUS
Filed Aug. 12, 1939

Serial No.
289,763.
7 Sheets-Sheet 5

Fig. 18.

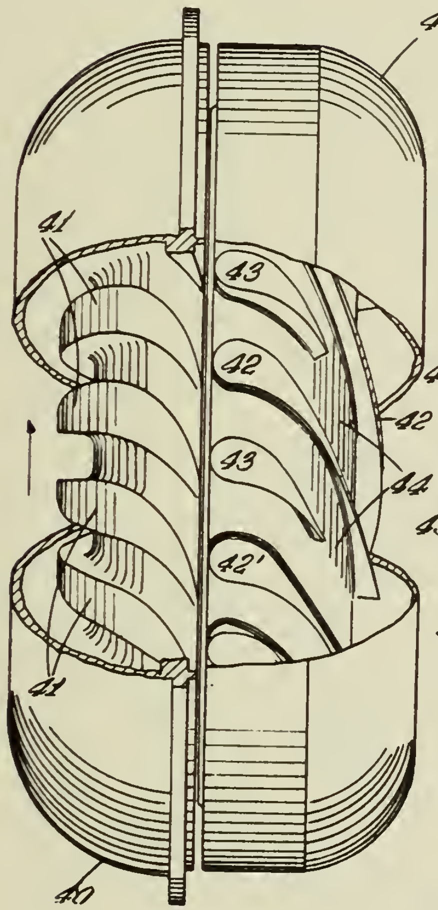
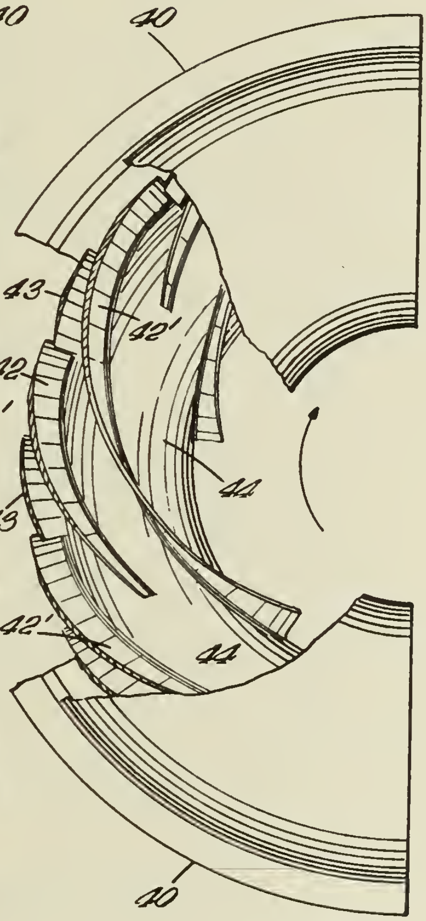


Fig. 19.



INVENTOR:
PIERO MARIANO SALERNI
BY: Haseltine, Lake & Co
ATTORNEYS

PUBLISHED
JUNE 15, 1943.
BY A. P. C.

P. M. SALERNI

HYDRAULIC POWER TRANSMISSION APPARATUS

Filed Aug. 12, 1939

Serial No.
289,763

7 Sheets-Sheet 6

Fig. 20.

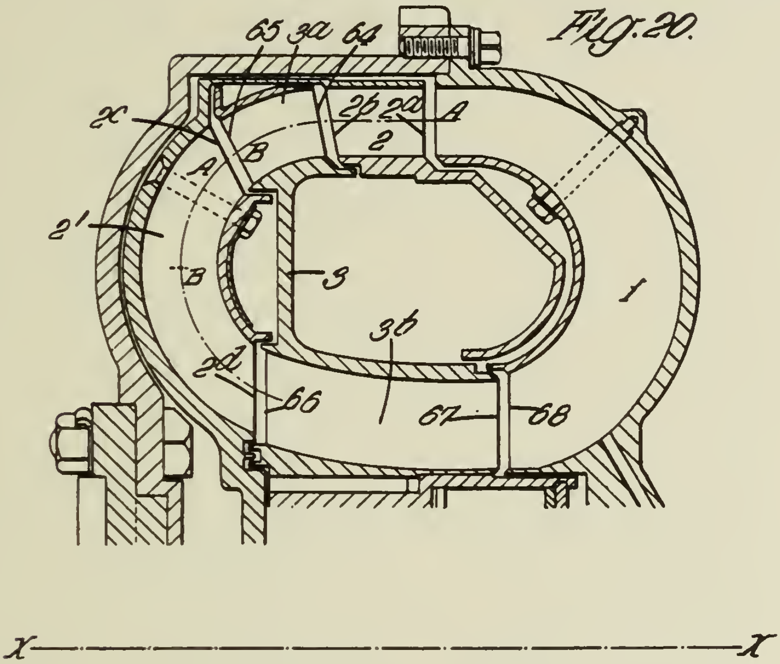
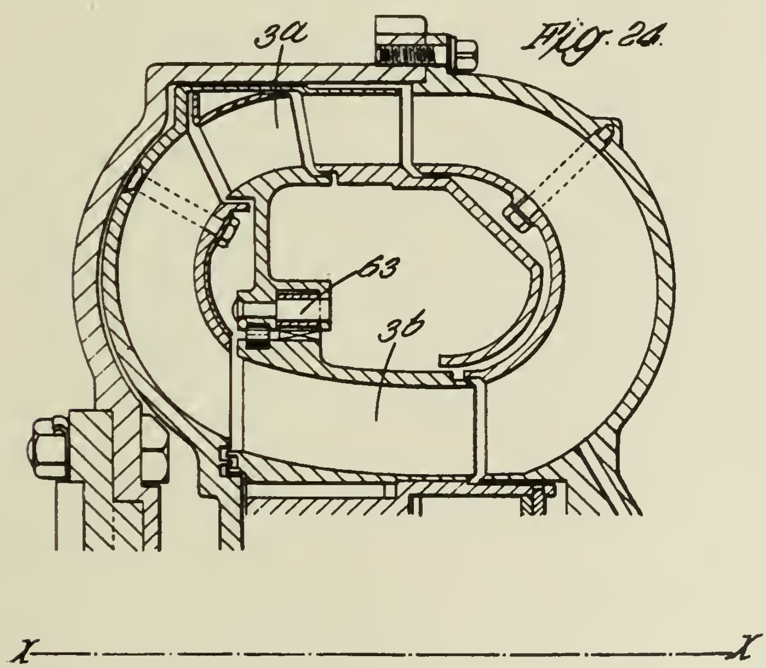


Fig. 21.



INVENTOR:
PIERO MARIANO SALERNI
BY: Haseltine, Lake & Co.
ATTORNEYS

PUBLISHED	P. M. SALERNI	Serial No.
JUNE 15, 1943.	HYDRAULIC POWER TRANSMISSION APPARATUS	289,763
BY A. P. C.	Filed Aug. 12, 1939	7 Sheets-Sheet 7

Fig. 21.

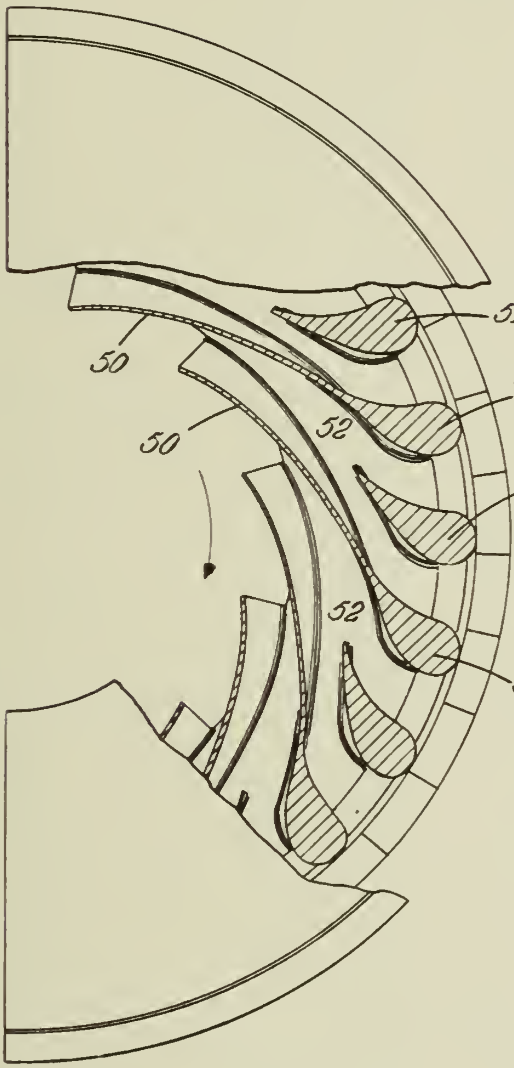
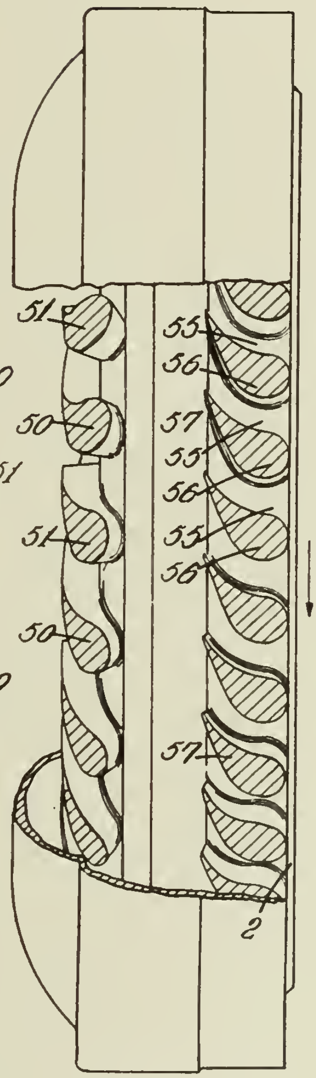


Fig. 22.



INVENTOR:
PIERO MARIANO SALERNI
BY: Haseltine, Lake & Co
ATTORNEYS

Published June 15, 1943

Serial No. 302,687

ALIEN PROPERTY CUSTODIAN

LUBRICATING OIL COMPOSITION

Franz Rudolf Moser, Amsterdam; Netherlands; vested in the Alien Property Custodian

No Drawing. Application filed November 3, 1939

This invention deals with compounded mineral lubricating oils and, more particularly, deals with the addition of polyvalent metal salts of rosin oil or tall oil to mineral oils to produce lubricating oils of improved antigumming properties for internal combustion engines, which oils have the property of preventing the sticking of piston rings when running these engines for long periods of time, and which have the ability to properly lubricate the cylinders and pistons under severe conditions of loading, i. e. which prevent cylinder abrasion.

It is known that in modern engines, such as high speed Diesel engines, aviation gasoline engines, etc., which, due to their high power output, operate at relatively high temperatures, piston rings have a tendency to become stuck in the grooves. Lacquer and/or carbon formation appear to be the principal reasons for this occurrence. The addition of small amounts of certain oil-soluble carboxylic salts, such as polyvalent metal salts of fatty acids and other carboxylic acids, is known known to reduce the ring-sticking tendencies. Many of the salts are not readily soluble in the mineral oil and, therefore, may settle out under lubricating conditions. Moreover, certain of these salts cause gelatinization while others are relatively expensive.

Now, in accordance with my invention, I have found that the polyvalent metal salts of liquid rosin oil when added to mineral oil in suitable quantities produce effective anti-ring-sticking lubricants which are relatively free from the above disadvantages.

Rosin oils are by-products of the paper industry and may be obtained by treating the wood of coniferous trees by the sulfate process for wood pulp production. In this process the chipped wood is boiled with a sulfate solution, and the residual waste liquor is allowed to separate in two layers, the upper layer being the rosin oil. Considerable quantities of such rosin oils are produced in Sweden and are often referred to as talloils.

Rosin oils consist predominantly of mixtures of rosin acids and fatty acids in varying ratios and also contain small amounts of unsaponifiable materials. Different rosin oils contain different rosin acids, and the fatty acids may be unsaturated. The degree of unsaturation may be very high, and this may be the reason why some of the rosin oil salts cause gummy precipitates. Sludging and precipitation of many rosin oil salts may be reduced considerably by partially hydrogenating the rosin oils. If hydrogenation is carried too far, however, polyvalent metal salts of the resulting hydrogenated rosin oil may be difficultly soluble in hydrocarbon oils. Therefore, hydrogenation should be carried out to a degree only so as to yield a hydrogenated product, the polyvalent metal salts of which are at least about 2% soluble in mineral lubricating oils.

When subjecting rosin oils to fractional distillation, the first fractions coming over normally consist mainly of fatty acids, while the higher boiling fractions usually consist predominantly of rosin acids and unsaponifiable substances. The middle fractions are usually composed of mixtures of fatty acids and rosin acids and are particularly suitable for my purpose if they contain the two types of acids in approximately equal amounts. The presence in lubricating oils of the unsaponifiable substances naturally contained in rosin oils may often be harmful, and it is, therefore, often desirable to eliminate these substances from the rosin oil either by distillation or by other appropriate means.

It is also possible to use soaps of fractions of talloil, which fractions can be prepared in several ways (vacuum distillation, treatment with solvents, and the like).

Thus, in order to prevent the usual oxidation tests of the lubricating oil being adversely affected by the addition according to my invention, the talloil may be subjected to a refining treatment, by which the most readily oxidizable part is removed. This refining treatment may be a known treatment for oils and greases, e. g. a treatment with sulfuric acid.

The treatment with sulfuric acid may be carried out as follows:

A quantity of talloil distillate is taken up in an equal volume of gasoline, whereupon 5% by weight concentrated sulfuric acid is added while stirring, the temperature being maintained at about 25° C. After this treatment the acid tar is removed, whereupon 10% by weight terrana or adsorption agent is added, the gasoline is distilled off and the mixture of talloil and terrana is kept for some time at a temperature of 150° C., while steam or an inert gas is blow through it. After cooling the mixture is filtered; the refined talloil thus obtained has become appreciably lighter in colour.

I have found that for good solubility of the polyvalent metal salts in mineral lubricating oils, it is desirable that mixtures of fatty acids and rosin acids be employed in which the ratio of rosin acids to fatty acids is between the limits of about 4:1 and 1:4 and preferably about 1:1. This

latter ratio of fatty acids to rosin acids is approximately that found in many of the rosin oils produced in Sweden.

In general, the rosin acids are far superior to fatty acids as ring-sticking inhibitors, whereas the fatty acids and, more particularly, unsaturated fatty acids tend to promote the solubility of the rosin acids in mineral lubricating oils. If a natural rosin oil is deficient in one or the other types of acid, it may be desirable to cure this deficiency by adding a suitable amount of that type of acid which is lacking. For example, I may utilize the lowest or higher boiling fractions, as the case may be, obtained in the fractional distillation of suitable rosin oils for blending back. Likewise, I may produce suitable blends of the lowest and higher boiling fractions, preferably selecting those of the higher boiling fractions which are substantially free from the unsaponifiable substances.

The rosin oil salts can be produced, for example, by double decomposition of rosin oil neutralized with lye and water-soluble salts of polyvalent metals. The desired salts are precipitated and then separated. Purified rosin oil salts may be obtained by extracting the precipitate, for instance, with ether or benzene in which they dissolve, whereupon they may be recovered by evaporating the solvent. Or else the rosin oil may be directly saponified with the oxide or hydroxide of the desired metal, preferably while stirring and heating to 100°C.-200°C.; the occasional addition of a small quantity of water promotes the dissolution. It is advantageous to use an amount of the metal of the saponified agent in excess of the mol equivalent of the acids contained in the rosin oil, because in this manner basic rosin oil salts may be produced which are less corrosive than the normal salts.

The use of a more than equivalent quantity of metal oxide presents the advantage of reducing the corrosive properties of the soap, practically even to zero. If talloil soaps are produced from equivalent quantities of metal oxide and talloil, it has been found that mixtures of neutral soaps, basic soaps and free acids are obtained, the latter causing corrosiveness. These free acids may be removed by the use of a larger quantity of oxide; they may also be removed or rendered innocuous by other chemical or physical methods. The excess of oxide admissible in connection with the solubility of the soaps in lubricating oil can be readily determined by experiment in each case.

Of the polyvalent metals whose salts of rosin oil may be suitable for anti-ring sticking purposes, magnesium, calcium, strontium, barium, cadmium, zinc, nickel, cobalt, and aluminum seem to be most active. Especially effective are the rosin oil salts of magnesium, calcium and zinc.

Although I prefer to use about .5 to 2% of the rosin oil salts in my lubricating oil, amounts may be varied from approximately .2 to 5%. Amounts in excess of the 2% limit may cause undue increase in viscosity, jelling of the oil, and a tendency to cause substantially permanent emulsions. The tendency toward emulsification varies with different metals in the salt. For example, the zinc salts do not cause permanent emulsions when used in amounts up to 5%, particularly if they are well purified, as by extraction or fractional distillation of the talloil. In the following table data are presented showing the effectiveness of different concentrations of the zinc salts of rosin oil as anti-ring-sticking agents in a medium grade mineral lubricating oil in a Deutz gasoline engine. The tests were made at 1200 RPM and were of 12 hour duration, while maintaining a jacket temperature of about 200° C.

Table

Concentration of rosin oil-zinc salt	Ring-sticking [1][2]	Formation of carbon on the inside of the bottom of the piston [1]	Formation of carbon in the ring grooves [1]
Percent		*Grams*	*Grams*
2	0.0	0.35	0.34
1	0.0	1.03	0.51
0.5	0.2	1.53	0.84
None	1.0	2.34	1.29

[1] Average values of a number of experiments.
[2] 1.0 = one ring completely stuck all the way around; the values of the four rings were totalled.

Crankcase lubricating oils containing salts of rosin oil may also contain other compounding ingredients, such as oxidation inhibitors, anti-corrosion agents, other soaps, pour-point depressors, blooming agents and extreme pressure agents, preferably those containing at least one of the elements of phosphorus, sulfur, or chlorine.

The following examples further illustrate our invention:

Example I

About 1% by weight of a zinc salt of "Swedish" tall oil was added at 100°C to a Venezuelan lubricating oil distillate (aviation grade lubricating oil) refined with furfural. The resulting lubricating oil was found to be suitable for internal lubrication of Diesel engines, materially retarding ring-sticking. Upon use no sediment was formed and the oil gave no rise to gum formation.

Example II

A crude talloil is distilled in vacuo with steam until about 85% distillate has been obtained. First runnings of about 15% are not used, because they contain substances that would impart a disagreeable odour to the final product. Zinc oxide, in a 25% excess calculated on the normal soap, is added, while stirring, to the distillate (acid figure 162) consisting of approximately equal parts of resinic acids and fatty acids. The dissolution of the zinc oxide, which is continued until a clear solution has been obtained, is effected by heating up to about 200°C. From time to time some water is added in order to promote the dissolution. If 1 to 2% by weight of the product obtained is added to a lubricating oil, ringsticking and carbon deposition are avoided and no corrosiveness is found.

Example III

10% sodium hydroxide solution is added to a talloil distillate according to Example II in a 100% excess—calculated on the acid figure of the talloil and then a magnesium chloride solution is added in a 100% excess.

The precipitate is washed by suspension in water and dried at 120°C. The product obtained has an ash content 38% higher than that of the normal salt; it is readily soluble in lubricating oil and does not impart any corrosive properties to it. Ring-sticking and carbon deposition are avoided by the addition of a quantity of 1 to 2% by weight of the said product to lubricating oil.

FRANZ RUDOLF MOSER.

Published June 15, 1943 Serial No. 304,859

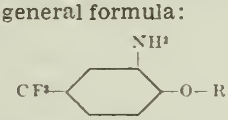
ALIEN PROPERTY CUSTODIAN

INTERMEDIARY PRODUCTS, DYES DERIVED FROM THE SAME AND THEIR MANUFACTURING PROCESSES

Pierre Petitcolas, Rouen, France; vested in the Alien Property Custodian

No Drawing. Application filed November 16, 1939

The present invention relates more particularly to novel commercial products which can be used especially as intermediary products for manufacturing valuable colouring materials, the aromatic amines of the general formula:



in which R represents an arylic rest containing eventually substituents such as halogen atoms, the methyl groups, methoxy groups and other similar groups. The invention also relates to a process for manufacturing these products and the dyes derived from the same.

According to the invention the amines corresponding to the above mentioned formula are obtained by the reduction of the condensation products of the 1-trifluoro-methyl-3-nitro-4-chlorobenzene with the alkaline phenolates. The condensation is preferably conducted in the absence of water and in the presence of an excess of the reacting phenol which is used as a solvent. As alkaline phenolates may be used the phenolates of the phenol, of the ortho, meta and para-chlorophenols, of the ortho, meta and para-cresols, of the mono-alcoylated derivatives of the resorcine and of the hydroquinone. The reduction of the so obtained condensation products is effected by means of one of the known general methods for the reduction of a group NO^2 bound with an aromatic nucleus to a group NH^2

The so obtained amines are diazotable and their diazoic derivatives can be copulated in the substance or on the textile fibres with the usual copulation components.

The dyes which have been formed in the substance can be used, according to their constitution, for the coloration of the fibres, of plastic materials, paper, rubber and the like; they can undergo various treatments such as dispersion, solubilization by esterification and the like.

The production of dyes acting on the fibre can be effected in view of the dyeing of cotton, viscose and other natural or artificial fibres with or without any intermediary formation of nitrosamines, of diazoaminated derivatives, diazosulphonates, bases of Schiff and the like.

The following examples of execution of the invention are non limitative ones:

Example 1

150 parts of phenol are added with 35 parts of pure caustic potash. The water which is formed is completely distillated by heating the mixture up to 200° C. After cooling to 110° C., 112 parts of 1-trifluoromethyl-3-nitro-4-chlorobenzene are added. The temperature rises by itself up to about 160° C. The mass strongly thickens owing to the precipitation of potassium chloride. This temperature is maintained during 10 minutes, then the mass is poured onto 2000 parts of water. The precipitated oil is washed repeatedly through decantation and then distillated in vacuum. 115 parts of 2-nitro-4-trifluoromethyl-1.1'-diphenylether are obtained. (Melting point: 33° C., boiling point: 194° C. under 25 millimetres.)

A reducing mixture is prepared with:

	Parts
Iron	150
Water	400
Acetic acid	20

The mixture is boiled during 15 minutes, then 100 parts of the foregoing condensation product are added. After stirring during a few hours while boiling, the reduction is terminated. The mass is neutralized with sodium carbonate and filtered when boiling. A portion of the liquid base goes into the filtrate. The extraction is then achieved with hot ethylic alcohol which, through dilution, yields the rest of the base. This oil is distillated in vacuum. It passes at 198/203° C. under 25 millimetres. The yield is of 75 parts.

The so obtained amine is diazotated and then converted into chlorozincate of diazonium. The solutions of this diazonium salt can be used for dyeing for the development of the fibres which have been grounded by means of alkaline solutions of copulation components having a substantive character. The shades which are obtained with various copulating agents are as follows:

With diacetoacetyl-o-toluidine	Yellow
With beta-oxynaphtoyl-aniline	Scarlet
With beta-oxynaphtoyl-m.nitraniline	Red
With beta-oxynaphtoyl-beta-naphtylamine	Scarlet
With beta-oxynaphtoyl-5-chloro-o-toluidine	Do
With beta-oxynaphtoyl-p-anisidine	Do
With beta-oxynaphtoyl-o.toluidine	Do
With beta-oxynaphtoyl-alpha-naphtylamine	Red
With beta-oxynaphtoyl-o.anisidine	Scarlet
With beta-oxynaphtoyl-p-chloro-o-anisidine	Do
With beta-oxynaphtoyl-4.6.dimethoxy-3-chloro-aminobenzene	Brown

Example 2

In conditions similar to those of Example 1, by substituting para-chlorophenol for the phenol, the 1.nitro-2-p.chlorophenoxy-5-trifluoro-methylbenzene is obtained which has a melting point of 47° C. and which, when reduced, yields the 1.amino - 2-p.chlorophenoxy-5-trifluoro-methylbenzene having a boiling point of 200–201° C. under 20 millimetres.

By copulation of the diazonium salts of this base on the fibre with the copulating agents mentioned in Example 1. shades are obtained which are similar to the shades indicated in this example.

Example 3

In conditions similar to those of the Example 1 and by substituting ortho-cresol for the phenol, the 1.nitro - 2-o.tolyloxy-5-trifluoro-methyl-benzene is obtained which has a melting point of 80° C. and which, when reduced, yields the 1.amino-2-o.tolyloxy-5-trifluoro-methyl-benzene; this base is diazotated and copulated with the sodium salt of the 1.naphtol-4-sulphonic acid; a dye is obtained which is soluble in water and which dyes the wool with a shade of a bright red.

PIERRE PETITCOLAS.

Published June 15, 1943

Serial No. 304,666

ALIEN PROPERTY CUSTODIAN

CYLINDER FIN CONSTRUCTION FOR AIR-COOLED ENGINES

Theodor Helmbold, Munich, Germany; vested in the Alien Property Custodian

Application filed November 16, 1939

It is usual with air-cooled internal combustion engines to provide the cylinder walls with fins which are intended to enlarge the surface in order to obtain a more rapid radiation of heat produced within the cylinder to the cooling air.

There are known quite a number of most different forms of constructing fins. It has been proposed in this connection instead of arranging the fins annularly along the entire periphery to subdivide them and to arrange the different fin parts in stagger so that the air is not allowed to flow through between two radiating fins without resistance, but is forced to flow the way prescribed. All forms of construction of radiating fins, known hitherto of the said type, are based on the principle to originate a vortex motion of the cooling air stream as a consequence of its deflection and by this means to obtain a better removal of heat which is only possible at the cost of a high expenditure of output.

The object of the present invention is to provide for the removal of heat a favourable, i. e. in the first place a possibly non-vortical course of flow and to so construct the radiating fins the best possible removal of heat is obtained. By avoiding the formation of vortices at least the same cooling effect may be obtained with a considerable less power consumption. This is of great importance especially with air-cooled aircraft engines, for, as is known, the transition of heat is influenced by the variation of density, temperature and viscosity of air in accordance with different altitudes and besides that every economy of power, especially with increasing altitude, is of particular importance, precisely wth aircraft engines.

From this will result that the transition of heat must be increased with increasing altitude which e. g. may be effected by increasing the velocity of the cooling air. The cooling air velocity must be low in vicinity of the ground in order to keep this velocity within admissible limits, which requires very high radiating fins thus causing constructional difficulties. The way that suggests itself to solve the problem of obtaining a sufficient removal of heat would be to care for a multiplication of the cooling area necessary at ground level in accordance with the provided maximum flying altitude, which fails owing to the fact that the clear span between the fins permits no further reduction for manufacturing reasons as it is already the case with air-cooled cylinders for aircraft engines.

Besides the manufacturing difficulties a reduction of the clear span between the fins is not practicable in the main for the reason that a certain lower limit must not be exceeded which is conditioned in so far, that the cooling air, when flowing along the walls, is submitted to an increasing braking effect and hence a limit layer growing with the course of flow is produced, in which a bad emission of heat takes place.

The possibility of increasing the heat transmission according to the invention is based on the fact that the limit layer continuously growing with the course of flow may be considerably reduced by interrupting the course of flow. This is obtained by subdividing in single fin parts in which case the intervals between the single plates must have about the length of the plate passed over previously in order to obtain the desired result. Owing to the diminution of the thickness of the limit layer, thus obtained, it is possible to reduce the clear span between the fins along the cylinder wall so far, that it requires no consideration. The invention provides for this reason very closely spaced fins of thin sheet metal in which case the single fin plates are in staggered relation to each other and fitted outwardly in a suitable manner.

From the knowledge according to the invention results that no constructional difficulties will occur when keeping the distance between the fins unlimited small. For this reason a cooling area has been provided which represents a multiple of the largest surface hitherto possible with radiating fins and ensures a sufficient and practicable air cooling even in the case of altitude engines; practicable in so far as the power needed for this purpose is within admissible limits.

The constructional execution of fixing the single fin parts may be realized e. g. by soldering or welding to the surface to be cooled or the single parts may be casted to the outside of the cylinder or any other manner of fixing may be choiced for the purpose in question.

It is of particular importance in this connection that in consequence of the thin-walled fins and of the unlimited small distance between the fins there does not occur any formation of vortices in spite of subdividing the fins in single plates. By giving the fin parts a stream-lined section seen in the direction of the cooling air current, it is possible to further avoid the formation of vortices. In this case approximately the entire fall of pressure along the whole course of flow, which otherwise is consumed by the formation of vortices, may be utilized to overcome the

increased wall friction occurring with the device according to the invention.

The particular advantage of the invention consists in a considerable economy of power, for in the case of heat transmission by the formation of vortices such a high expenditure of power is necessary that it is no longer in a reasonable relation to the delivered engine power, particularly for the large quantities of heat to be carried away with aircraft engines. In addition to that by the formation of vortices itself again heat is produced, which impairs the emission of heat from the cylinder wall. Besides that the fins that would be necessary for producing vortices would have a much higher weight than those according to the invention.

By subdividing the radiating fins according to the invention avoiding the formation of vortices on the one hand and by the possibility to increase the cooling area by a multiple on the other hand a substantial improvement of the transmission of heat is obtained, the power necessary for cooling being simultaneously reduced.

Many series of tests have proved that e. g. with altitude engines the cooling based on the vortex principle is not practicable at all owing to the high power necessary for this purpose. In contrast to this the power necessary for the cooling according to the invention is well within reasonable limits.

Fig. 1 of the drawing shows the cylinder 1 with the single fin plates 2 which are very closely spaced one upon another. The intervals 3 correspond about the length of the fin plates 2.

Fig. 2 is a section through the cylinder 1 showing the arrangement of the single fin plates 2.

THEODOR HELMBOLD.

PUBLISHED

JUNE 15, 1943.

BY A. P. C.

T. HELMBOLD
CYLINDER FIN CONSTRUCTION FOR
AIR-COOLED ENGINES
Filed Nov. 16, 1939

Serial No.
304,666

Fig. 1

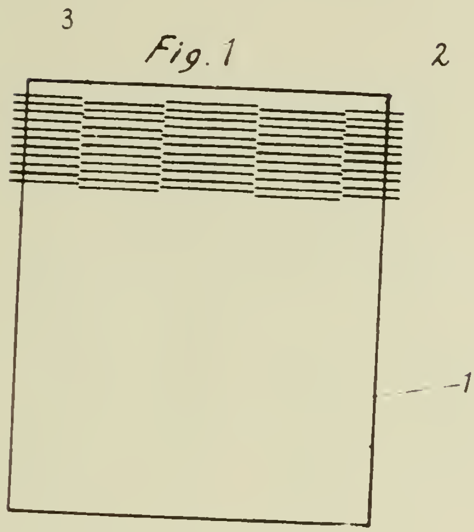
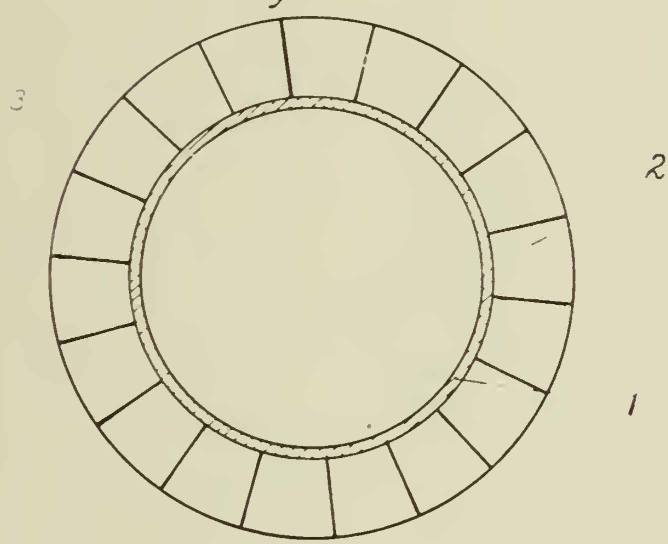


Fig. 2



INVENTOR:
THEODOR HELMBOLD
by
ATTORNEYS

Published June 15, 1943 Serial No. 307,933

ALIEN PROPERTY CUSTODIAN

HETEROPOLYMERIC PEROXIDES FROM ALIPHATIC KETONES

Franz Rudolf Moser, Amsterdam, Netherlands; vested in the Alien Property Custodian

No Drawing. Application filed December 6, 1939

This invention relates to novel and useful heteropolymeric peroxides from aliphatic ketones. More particularly, the invention is concerned with a class of new heteropolymeric peroxides from reaction, under peroxide-forming conditions, of a ketone with a dissimilar ketone.

It is known that homopolymeric ketone peroxides may be produced by treating a ketone in an acid medium with hydrogen peroxide, or by oxidizing the ketone with a solution of persulfuric acid which has been hydrolyzed by a brief heating. The peroxides obtained in such a manner are exclusively homopolymeric peroxides which are chiefly in the dimeric and trimeric forms. Thus, when acetone is used as the initial reactant, a reaction product is obtained which consists of a mixture of dimeric and trimeric acetone peroxides. Similar homopolymeric ketone peroxides are known to result from treatment of a higher ketone.

These homopolymeric peroxides are valuable materials which may be used for various purposes. Their powerful oxidizing character makes them useful to bleach flour, textile materials, paper, and the like. They may also be applied in the manufacture of synthetic organic products such as pharmaceutical preparations. They are, however, particularly effective as ignition promoters for use with liquid fuels for Diesel and semi-Diesel engines. For the last mentioned use, the homopolymeric peroxides have several disadvantakes which make them unsuitable for commercial application. For example, acetone peroxides have fairly high melting points so that they are solid at ordinary room temperature and they have poor solubility in fuels of the gas oil type. These disadvantages of the homopolymeric peroxides make it difficult or sometimes impossible to prepare concentrates of the peroxides in hydrocarbon oils which are important for economical and safe transportation of the peroxides which are considered too explosive to be shipped without diluents, and for the greater ease in apportioning these compounds in conventional types of blending equipment.

Now I have discovered that heteropolymeric peroxides of aliphatic ektones, contrary to what might be expected from knowledge of the properties of the homopolymeric peroxides. generally have very low melting points (a great many of them being liquids at ordinary temperatures) and have very good solubility in hydrocarbon oils, most of the practical members being miscible in all proportions with oils of the gas oil type. Furthermore, they are at least equal to and are generally more effective than the homopolymeric peroxides, for ignition promotion purposes. For example, the homopolymeric peroxides of acetone are solids at ordinary temperatures, the dimeric acetone peroxide having a melting point of 132°C. and the trimeric acetone peroxide possessing a melting point of 95°C. The homopolymeric peroxides of methyl ethyl ketone also have melting points above room temperature. However, the heteropolymeric peroxides which result from treatment of a mixture of acetone and methyl ethyl ketone under peroxide-forming conditions have a melting point which is below 0°C, and they are oily liquids at ordinary temperatures.

The peroxides of the invention which result from the treatment of a mixture of aliphatic ketones are true heteropolymeric peroxides. They are not merely mixtures of the homopolymeric peroxides from the individual aliphatic ketones used in mixture as the reactants. Such a mixture of ketones would be expected to obey the physical laws and have a melting point lower than that of any particular component in the mixture. While the use of a mixture of aliphatic ketones does lead to the minor formation of some homopolymeric peroxides, the reaction product may be separated into individual components and true compounds of a heteropolymeric character obtained which have such unexpected and desirable properties.

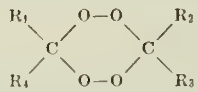
The heteropolymeric peroxides may be prepared by oxidizing a mixture of aliphatic ketones in any of the known manners which are conducive to the formation of peroxides. For example, the mixture may be oxidized in an acid medium with hydrogen peroxide, with hydrolyzed persulfuric acid, or with Caro's acid (H_2SO_5).

The known peroxides of ketones are believed to be compounds, in the case of the dimeric form, wherein two identical hydrocarbon groups of the ketones are joined through oxygen atoms. Trimeric forms contain three identical hydrocarbon groups joined through oxygen atoms. The exact nature of the oxygen linkages between the groups has not, however, been conclusively established. The heteropolymeric peroxides of the invention, while they have the same type of oxygen linkages, are compounds wherein the groups have different structural configuration of atoms, have a different number of atoms, or have both. For example, when peroxides are prepared from a mixture of acetone and methyl ethyl ketone, the dimeric product obtained, disregarding the incidental homopolymeric peroxides, is built up from

one molecule of acetone and one molecule of methyl ethyl ketone and the trimeric products are built up from one molecule of acetone and two molecules of methyl ethyl ketone and from two molecules of acetone and one molecule of methyl ethyl ketone. These three heteropolymeric peroxides exemplify compounds where the number of carbon atoms are different in the groups.

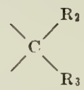
Thus the products of the invention are the heteropolymeric peroxides resulting from treatment under peroxide-forming conditions of at least two aliphatic ketones possessing a different number of atoms and/or a different structural configuration of atoms.

The heteropolymeric peroxides of the invention in the dimeric form may have a structural formula represented by the formula

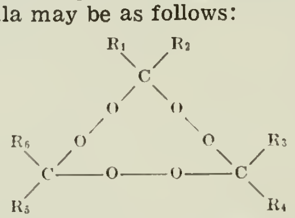


wherein R_1, R_2, R_3 and R_4 are aliphatic hydrocarbon radicals, with the linkage to the radical being on a carbon atom thereof and the group

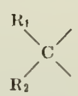
is dissimilar from the group



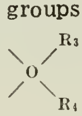
by structural configuration of atoms and/or number of atoms therein. In the case of the trimeric form of the heteropolymeric peroxides, the structural formula may be as follows:



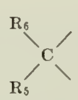
wherein R_1, R_2, R_3, R_4, R_5, and R_6 are aliphatic hydrocarbon radicals, with the radical linkage being on a carbon atom thereof and the group



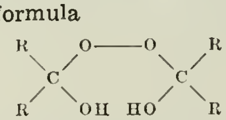
is dissimilar from the groups



and



by structurel configuration of atoms and/or number of atoms therein. However, the exact structural configuration of peroxides of ketones has not been conclusively established in the art. For example, the formula



has also been proposed for the dimeric peroxides. Therefore, while the above-mentioned formulae may further clarify the invention, I do not wish to be limited to compounds with these formulae owing to the uncertainty which is at present prevalent in the art.

The heteropolymeric peroxides may be prepared from a mixture of any suitable ketones. Examples of ketones are acetone, methyl ethyl ketone, methyl isopropyl ketone, mesityl oxide, diacetyl, acetyl acetone.

The reaction products containing heteropolymeric peroxides from a mixture of aliphatic ketones may be used as such in numerous applications or they may be separated and purified by any suitable method such as steam distillation, fractional crystallization, solvent extraction, and the like. A very useful class of heteropolymeric peroxides are those resulting from the use of acetone as one reactant and a dissimilar ketone as the other. It is preferable to use a ketone containing not more than 12 carbon atoms per molecule for the second reactant.

The heteropolymeric peroxides are in general very useful materials which, besides being particularly suitable for use in fuels which application is claimed in my copending application Serial No. 291,361, filed August 22, 1939, may also be used for bleaching flour, textiles, paper pulp, and the like; for preparation of pharmaceuticals and other synthetic products; for oxidizing agents for promoting the drying of paints and varnishes; for bactericides and germicides; and the like.

The invention may be more clearly indicated by the following example which is given for illustrative purposes only.

About 163 cm^3 of highly concentrated sulfuric acid were added to 130 cm^3 of water and after the mixture had cooled down to room temperature, 113 gms of hydrogen peroxide of 30 per cent. concentration were added. The mixture was then cooled to approximately $-18°$ C., and a mixture of 36 gms of methyl ethyl ketone and 29 gms of acetone added in portions while stirring, care being taken that the temperature did not rise above 0° C. After addition of the ketones the mixture was allowed to stand for about 15 minutes and then water was added until the total volume was one liter, whereupon a colorless viscid upperlayer separated. This layer was freed of acid and any traces of unconverted ketones by washing with water, and then dried over sodium sulfate and filtered. The product was purified by steam distillation. The distillation yielded a small quantity of first runnings containing dimeric and trimeric acetone peroxide while the main mass consisted of the desired heteropolymeric peroxides with some methyl ethyl ketone peroxides in the least volatile fraction.

The ignition promotion qualities of the heteropolymeric peroxides were tested by adding them to a Diesel fuel and noting the increase in cetane number of the fuel. The cetane number of the Diesel fuel containing no added peroxides was about 41. The addition of about one per cent, heteropolymeric acetone-methyl ethyl ketone peroxides increased the cetane number to about 56. Addition to the fuel of one per cent. trimeric acetone peroxide or of one per cent. methyl ethyl ketone peroxide increased the cetane number of the same fuels only to about 53.

FRANZ RUDOLF MOSER.

Published June 15, 1943

Serial No. 309,471

ALIEN PROPERTY CUSTODIAN

METHOD OF EXTINGUISHING FIRE

Karl Friedrich, Berlin-Wilmersdorf, Germany; vested in the Alien Property Custodian

No Drawing. Application filed December 15, 1939

This invention relates to a method of extinguishing the fire of burning chips of a metal or metals rich in magnesium, such as the so called electron metal. This method consists in pouring a chemically inert liquid or oil over the burning chips, especially paraffin oil.

It may happen that this paraffin oil when poured over the electron metal chips is ignited by the projecting hot chips, so that at some places a small fire of burning oil breaks out instead of the fire of the chips. This oil fire may now be readily extinguished by other means, as, for instance, by a carbon dioxide snow or dry extinguisher, or by the oil itself. However such ignition of the oil used for extinguishing the fire may be avoided by employing an oil which is saturated with carbon dioxide. By setting oil under carbon dioxide pressure a considerable part of the carbon dioxide gas will be dissolved in the oil.

Now I have ascertained that the use of such oil saturated with carbon dioxide is extraordinarily useful for extinguishing the fire of electron metal chips, inasmuch as the carbon dioxide exerts an extinguishing action so that the oil itself is not ignited. When ejecting the oil saturated with carbonic-acid gas out of a pressure resisting container, a foaming up of the projected oil takes place so that the oil covers the fire with a sort of foam and extinguishes the fire as a carbon dioxide-oil foam.

Furthermore I have found it advantageous to admix a slight quantity of water to the oil, for instance, in form of an emulsion. The foam formed in presence of a little water is more stable than pure oil foam. This effect is probably due to the fact that the water contained in the oil foam tends to evaporate when the oil becomes hot and continuously accomplishes the formation of new foam whereby the ignition of the oil is prevented.

To incorporate the water into the oil recourse may be had to emulsifying substances such as soap.

Examples

1. One liter of a heavy mineral oil having a point of inflammation of about 250° is mixed with 20 grams olein and 20 grams of a 40 per cent potassium hydroxide solution are added while stirring. A uniform emulsion is obtained.

2. In one liter of hot heavy mineral oil 15 grams magnesium stearate are dissolved and 12 grams water are added to the solution, about 5 per cent of a wetting agent such as triaethanolamin or sodium butyl-naphthylenesulphonate being added to the water.

3. In one liter of hot heavy mineral oil 15 grams aluminum stearate are dissolved and 12 grams water are added to the solution, about 5 per cent of a wetting agent such as triaethanolamin or sodium butyl-naphthalenesulphonate being added to the water.

The obtained emulsions are saturated in a pressure resisting container and when required projected or poured onto the fire.

KARL FRIEDRICH.

Published June 15, 1943

Serial No. 310,443

ALIEN PROPERTY CUSTODIAN

ADDRESS PRINTING MACHINE

Joseph Krell, Berlin-Zehlendorf, Germany; vested in the Alien Property Custodian

Application filed December 21, 1939

This invention relates to an address printing machine provided with a device for conveying the pieces or sheets or the like of paper, for instance forms, through the machine intermittently and automatically.

It has already been suggested to make use of endless conveying bands running continuously in the same direction and serving for conveying the sheets etc. to be imprinted to and over the printing place. For holding fast the sheets etc. to be imprinted means holding the papers either only one time or several times are provided and are turned into the path of the said sheets. With these machines the conveying bands which are, in most cases, arranged in pairs cover a part of the sheet to be imprinted so that the sheet can be imprinted only on a part of its surface. But not only the conveying bands, also the holding means reduce the surface available for the print, in that these means take hold of the sheet at the rim thereof whereby printing directly at the rim is rendered impossible. With said older machines there is, thus, the sheet portion available for the printing considerably smaller than the sheet itself, so that it is, first of all, rendered impossible to imprint rim portions of the sheet.

The object of the invention is to provide an arrangement able to render possible to imprint the sheet on any desired place, thus, on the rims, too. Another object of the invention consists therein to increase the safety of service of the machine by combining the means control and the conveying means with one another.

The invention consists especially therein that in front of the printing place, as well as therebehind, a conveying roll gearing or conveying roller gearing is provided and both these gearings are driven synchronously and intermittently.

While the above-mentioned conveying roll gearings or conveying roller gearings serve solely for conveying the piece or sheet of paper, especially forms, to the place below the printing place, there is also provided, according to the invention, another conveying gearing, preferably designed as a conveying band, the purpose of which is to feed the sheets etc. to be imprinted to said printing place.

The improved address printing machine designed according to this invention is distinguished especially also by the feature that firstly every form etc. moved by the conveying gearing over the printing place in portions of any number and any length is provided, if the printing arm forming a member of the machine is repeatedly operated in correspondence with the number of said portions, with a corresponding plurality of imprints following one another in the direction of motion of the form etc., and secondly, when the thus imprinted form leaves the step-wise operating conveying gearing, it is further conveyed out of the machine by another conveying device separately provided for this purpose.

A constructional form of the address printing machine particularly suited for the purpose in view is characterised by the further features that the two conveying gearings are coupled with one another in a particular manner and that a selectively engaging and disengaging clutch forms one of the driving members therefore. In connection therewith a ratchet mechanism may be provided for stopping the conveying roller gearing, the pawl of this mechanism being preferably disengageable in the requisite periods of time with the aid of a control cam. A particularly simple arrangement of the members concerned is obtained by providing the ratchet toothing co-operating with the pawl of the ratchet mechanism and determining the length of the conveying paths of the conveying roller gearing at an exchangeable disk. The applicability of the entire device is still more increased by the provision that the conveying gearings arranged in front of, and behind, the printing place, as well as the intermittently operating driving members, are arranged upon a frame attached reversibly to the table plate of the machine.

The invention is illustrated diagrammatically and by way of example on the accompanying drawings on which Figure 1 is a front-view of the machine, Figure 2 is a conveying device operating in an echelon-wise manner, this device being shown partly in front-view and partly in section; Figure 3 is a side view of the conveying device shown in Fig. 2, partly in section; Figure 4 shows the left-hand end of Fig. 3 completely in section, and the Figs. 5–11 are illustrations of a partly recessed or cogged disk in seven different positions, together with certain members co-operating therewith, all as fully described hereinafter.

Referring in the first place to Fig. 1, **1** denotes the table plate of an address printing machine designed according to this invention, and **2** denotes a printing arm located above said plate and being vertically oscillable in known manner, and moved in this manner by means which, being known, do not form parts of the invention. Attached to the lower face of said arm is a printing cushion **3**, which determines the place of the machine where a form or the like is to be

provided with a certain definite imprint. The table is provided with a guide (not shown) for printing blocks, printing plates or the like contained in a store receptacle and being successively withdrawn therefrom, whereafter the respective block etc. is moved past below the arm 2 and finally deposited in another receptacle 5 situated below the table 1.

7 denotes a pile of the forms etc. to be imprinted, and 6 is a stationary plate supporting the pile. Above the table is a plate or box or the like 8 which is to receive the imprinted forms etc. Several means are provided for conveying the forms etc. individually from the pile 7 to the printing place and to the plate or box 8. In the constructional form shown by way of example the individual sheets are withdrawn from the pile by means of a suction lifter 9 of any suitable design, and are then further conveyed by means of an endless band 10 in the direction indicated by the arrow 11 whereby they are conveyed to two groups 12 and 12′ of conveying rolls, of which the one group is located in front of the printing arm 2 and the other is located therebehind. I wish it to be understood that rollers may be used instead of the rolls. This part of the machine is in either case so designed that the sheet to be imprinted comes to a standstill below the printing arm at least one time, may be, however, several times, so that it can be imprinted during the pause or pauses. Owing to this manner of operation I have termed the device in question proportionating conveyor. Behind it is provided an endless conveying band 13 by which the imprinted sheets are conveyed upwardly to the collecting box 8 in the direction indicated by the arrow 14.

The proportionating conveyor is illustrated separately in the Figs. 2–4 which are drawn to a greatly enlarged scale relatively to Fig. 1. In front of, and behind, the printing place are shafts 15 and 15′ supported in bearings 16, 16′ and 17, 17′ supported in turn on the table 1 of the machine. The bearings 17, 17′ are constituted by horizontal arms (Fig. 2) located opposite to one another and supported in common by a bearing 18 (Figs. 3 and 4). To each of the shafts 15, 15′ is affixed a roller, or a pair of rolls 12, 12′ respectively (Figs. 2 and 3). Below these rolls are housed in cavities of the table 1 pressure rolls 19, 19′ which are supported by arms 21, 21′ subjected to the action of compressive springs 20, 20′ by which they are pressed against said rolls. To the end of each of the shafts 15, 15′ is keyed a driving pinion 22, or 22′ respectively. Both pinions mesh with a cog-wheel 23 which is rotatably supported upon a shaft 25 supported in turn in the bearing block 18. At a side of the wheel 23 is a hub disk 24 (Fig. 4) which is likewise rotatably supported upon said shaft 25, and laterally from said disk is provided a ratchet wheel 26 that is coupled with the said disk by means of an eccentrically arranged pin 27. The members 23, 24 and 26 are located between two disks 28 and 29, of which the first is firmly connected with the shaft 25 by means of a pin, as shown in Fig. 4, whereas the other disk 29 is axially shiftable upon said shaft and coupled therewith merely by means of feather and groove. The disk 29 is subjected to the action of a compressive spring 30 located upon the outer end of the shaft 18 and retained in place by means of a knurled nut 31 by which the tension of said spring can be adjusted. Between the disks 26 and 29 is a layer of felt 34 and between the disks 23 and 28 is a layer of felt 35. The just described arrangement and combination of parts constitutes a friction clutch, by the intermediary of which the rotation of the disk 28 is transmitted to the cog-wheel 23. The spring 30 is so adjusted that the driven member 23, or 26 respectively, can be prevented from further rotations without any damage to the machine when the shaft 25 and the members connected with it continue to rotate. The disk 28 is provided with a toothing 32 with which a driving chain or another driving member may mesh.

At the rim of the table 1 is a projecting stationary horizontal arm 36 (Figs. 2 and 4) on which is supported a ratchet pawl 38 (Figs. 5–11) which is subjected to the action of a tensible spring 37. The pawl 38 lies within the range of the ratchet toothing of the disk 26. If the pawl 38 is, for instance. in the position shown in Fig. 2 and the shaft 25 and the parts connected with it are rotated in the direction indicated by the arrow 39, the disk 26 and the cog-wheel 23 coupled with it will be prevented from rotation. These parts can partake in the rotation only if the pawl 38 has been disengaged from the recess of the disk 26 with which it had been in engagement at the time being. For this purpose the disk 29 is provided with two cams 40, 41 located opposite the disk 26, and within the range of these cams is a roll 42 arranged laterally at the pawl 38. The cam 40 lies nearer to the axis of the shaft 25 than the cam 41 so that both cams describe two circles of different diameter.

The drive of the disk 28 is accommodated to the drive of the printing arm 2. It is suited to the object in view to provide also for a certain definite relation between the drive of the disk 28 and the drive of the gripper or suction lifter 9, so that the proportionating conveyor is supplied with another form in certain definite periods of time.

The band conveyors 10 and 13 run preferably continuously. As each sheet or form to be imprinted comes temporarily to a standstill prior to being seized by proportionating conveyor, the band conveyor 10 is provided with a pressure roller 43 or an equivalent member which is adjustable in the direction of motion of the sheet or form, so that a sufficiently large gap with respect to the proportionating conveyor according to the respective sheet or form can be provided for, in order to prevent the sheet or form from being upset by the proportionating conveyor when its front edge pushes upon the shaft of this conveyor while this shaft is at a standstill at the time being.

The manner of operation of the machine is as follows:

It may be supposed that a form comprising four portions (for instance a debit-note, a payment-certificate, a receipt, and an entry-certificate) is to receive an imprinted address upon each of said portions, the wording being the same on all portions.

The forms thus to be imprinted are assembled as a pile 7 which is placed upon the supporting plate 6. While the machine is in operation the forms are withdrawn successively from said pile by means of the suction gripper 9 and delivered upon the band conveyor 10 by which the forms are further delivered to the rolls 12 of the proportionating conveyor. The ratchet friction gearing inserted into the drive of the conveying rolls 12 and 12′ is so designed and controlled that the rolls come to a standstill in the same

moment in which the form contacts with them. Fig. 5 shows the position of the parts concerned in that moment. In this position the pawl 38 engages the particularly deep recess 44 of the ratchet disk 26. The cam 40 provided at the disk 29 which rotates continually in the direction indicated by the arrow 45 contacts, while it continues to rotate, with the roll 42 and lifts the pawl 38 out of the recess 44, whereby the locking of the disk 26 and, thus, also of the cog-wheel 23 is broken. Now also this wheel is rotated in the direction of the arrow 45, i. e. of the arrow 39, Fig. 2, whereby also the rolls 12 and 12′ are turned in the direction of said arrow 46. The form lying in front of the conveying rolls 12 is seized by them and moved below the printing arm. This forward feed of the forms lasts until the recess 47 following the recess 44 is being engaged by the pawl 38. Fig. 6 shows this position of the ratchet disk 26. By reason of this new looking of the disk 26 the cog-wheel 23 and the conveying rolls 12, 12′ have been brought to a standstill. Also the form now positioned below the printing arm, i. e. on the printing place, is there at a standstill. While this takes place, the first imprint is effected by the printing arm and the printing block attached to it being moved down upon the form, and immediately thereafter said arm and said block are again lifted.

While the printing takes place the cam 41 of the cam 41 of the disk 26 has approached the roll 42 of the pawl 38. When the printing arm with the block commences to rise, the cam 41 presses upon the roll 42 and lifts the pawl out of the recess 47, whereby the ratchet disk 26 and with it the cog-wheel 23 and the conveying rolls 12, 12′ are rotated. The form now seized by these rolls is conveyed further until the pawl 38 has entered into the next recess 48, when these members will be in the position illustrated in Fig. 7. In this position the conveyance of the form is again interrupted, and in this pause another imprint is effected by the printing arm etc., this second imprint being made on the second portion of the form. While this takes place the cam 40 has again approached the roll 42 of the pawl 38. The depth of the recess 48, combined with the slight distance between the cam 40 and the axle, is, however, so slight, that the cam 40 moves past the pawl 38 without lifting it out of the recess. The roll 42 of the pawl 38 will be lifted out of the recess in question only again by the cam 41, i. e. after a complete revolution of the cam disk 29. The ratchet disk 26 gets now from the position Fig. 7 into the position Fig. 8. In this position the pawl 38 has engaged the recess 49 of the disk 26 and the members coupled in the manner described with the disk 26, viz. the cog-wheel 23 and the conveying rolls 12, 12′ are at a standstill, and these rolls hold the form fast upon the printing place. Now the printing arm is depressed for the third time so as to produce an imprint upon the third portion of the form. When thereafter the printing arm has again been raised the cam 41 now contacting with the larger diameter presses upon the roll 42 and lifts the pawl out of the recess 39. The ratchet 26 and the members coupled with it in the manner described are further moved until the pawl 38 has entered into the recess 50, as shown in Fig. 9. By the rotation of the rolls 12, 12′ the forms has again been advanced by so much that its fourth portion lies below the printng arm, and while the form has now again come to a standstill, the fourth imprint is effected by means of the descending arm which instantly thereafter returns into its former, i. e. upper position. After the cam disk 29 has made another revolution the cam 41 presses again upon the roll 42 whereby the pawl 38 will be lifted out of the recess 50.

The drive of the conveying rolls 12, 12′ brought about by the just described procedures is utilised for delivering the imprinted forms out of the proportionating conveyor. The conveying time requisite for the deliverance can be shorter so that after a conveying rotation which is shorter than the preceding conveying rotations, the pawl 38 engages the recess 44′ particularly provided for the purpose in view. This recess pertains to the second group of the recesses of the ratchet disk. These recesses correspond with those already described in preceding paragraphs of this specification, the only difference being that they are staggered relatively to them by 180°. The position of the ratched disk corresponds, therefore, wtih the position shown in Fig. 5. Owing to the pawl 38 entering more deeply the roll 42 is now located within the range of action of the cam 40 so that the pawl is lifted out of the recess 44 already after a further semi-rotation of the cam disk 29.

In the period of time determined by this further the semi-rotation a fresh form must be conveyed to the conveying rolls 12.

As with the above described constructional form of the address printing machine there has been assumed that four imprints are to be made on the form, the feed for the printing block is so designed that a fresh feed, or an actuation of the fresh printing block takes place only after the printing arm has been four times depressed.

The form coming from the proportionating conveyor is taken hold of by the band conveyor 14 and is delivered into the box 8.

From the preceding description of the improved address printing machine appears that the control of the proportionating conveyor is determined essentially by the shape and the number of the recesses of the ratchet disk, wherefrom results that the manner of operation of the machine can be accommodated also to other conditions, for instance to the production of another number of imprints upon a form, and I am now going to describe a constructional form in which only one imprint is made on a form. In this case the ratchet disk is designed in the manner shown in Figs. 11 and 12. From these figures appears that a smaller number of recesses is provided in this case, viz. only two rests 51 and 52, the recess 51 corresponding with the deeper rest 44 of the first described constructional form, whereas the recess 52 has a smaller depth, as have also the recesses 47, 48, 49 and 50 of said first-described constructional form. The form is conveyed to the rolls 12 of the proportionating conveyor in the already described manner. In the moment in which the form contacts with the rolls 12 these latter are at a standstill, because the pawl 38 engages the recess 51 of the ratchet disk 26 (Fig. 10). The cam 40 of the continually rotating disk 29 lifts the pawl 28 out of the recess 51 when it depresses the roll 42 whereby the proportionating conveyor is rotated so that the rolls 12 take hold of the form and move it below the printing arm. The proportionating conveyor comes to a standstill as soon as the ratchet pawl 38 engages the recess 52 of the ratchet disk, as shown in Fig. 11. While the proportionating conveyor is at

rest, the printing arm is depressed and instantly thereafter raised, so that a second imprint is produced on the form. After half a revolution of the disk **29** the cam **41** depresses the roll **42** whereby the pawl **38** is disengaged from the recess **52**, in consequence whereof the proportionating conveyor is rotated so that the rolls **12**, **12'** discharge the imprinted form out of the machine. The proportionating conveyor remains in operative position until the pawl **38** engages the second recess **51** of the ratchet disk **26**.

It has, as regards the just described further constructional form of the machine, been assumed that the ratchet disk is provided with two recesses. It is, however, a matter of course that the invention is not restricted to this number of recesses of said disk. The design and arrangement and combinations of the members concerned may also be such a one that one complete revolution of the ratchet disk is requisite for every passage of a form, whereby, of course, another subdivision of the disk **29** would become necessary.

As the conveying members of the proportionating conveyor lie completely outside of the range of the printing arm, and as said members are provided in front of the printing place, as well as therebehind, an imprint can be produced on the form on any desired place thereof with the aid of a suitably designed control. If the rim zones of the form are to receive imprints and if, for this purpose, it is necessary to conduct the form eccentrically with respect to the printing place, the conveying rolls may be laterally shifted upon the shafts **15**, **15'**, as is indicated in Fig. 3. If a still longer shifting of said rolls is desired then counter rollers **19** which are suitably longer in their axial direction may be used.

The machine can be employed also if a continuous sheet of paper instead of individual sheets or forms is to be used. In this case, there may, under circumstances, the separate band conveyors be dispensed with, in which case attention is to be paid solely to the condition to provide for some slack with respect to the winding off and winding on of the continuous sheet so as to render possible an intermittent feed at the printing place.

In the construction form shown by way of example the proportionating conveyor is designed as a double conveying roll gearing. Also if rollers would be employed instead of rolls, the advantage of rendering it possible to imprint the form on any desired place could be realised. This advantage could, however, be obtained also if a thrust gearing or a gripper gearing permitting an intermittent feed of the sheet or form to be imprinted would be used.

With the constructional form shown and described has been assumed that the direction of feed extends in the longitudinal direction of the table, as does also the direction of feed of the printing blocks. The proportionating conveyor might, anyhow, be arranged also in such a manner that it conveys the sheets or forms to be imprinted transversely to the direction of the table, or of the printing blocks respectively. In order to provide for a convenient changeability of the members concerned for accommodating them to the various applications the proportionating conveyor is, according to a particular constructional form of the machine, arranged on a separate base plate or on a frame which corresponds to a bed at the table plate of the machine. If another conveying direction of the proportionating conveyor necessitates also a corresponding re-adjustment of the feed conveyor and of the discharge conveyor, this will become particularly easy if these additional conveyors are designed as self-contained additional devices.

JOSEPH KRELL.

PUBLISHED

JUNE 15, 1943.

BY A. P. C.

J. KRELL

ADDRESS PRINTING MACHINE

Filed Dec. 21, 1939

Serial No.

310,443

3 Sheets-Sheet 1

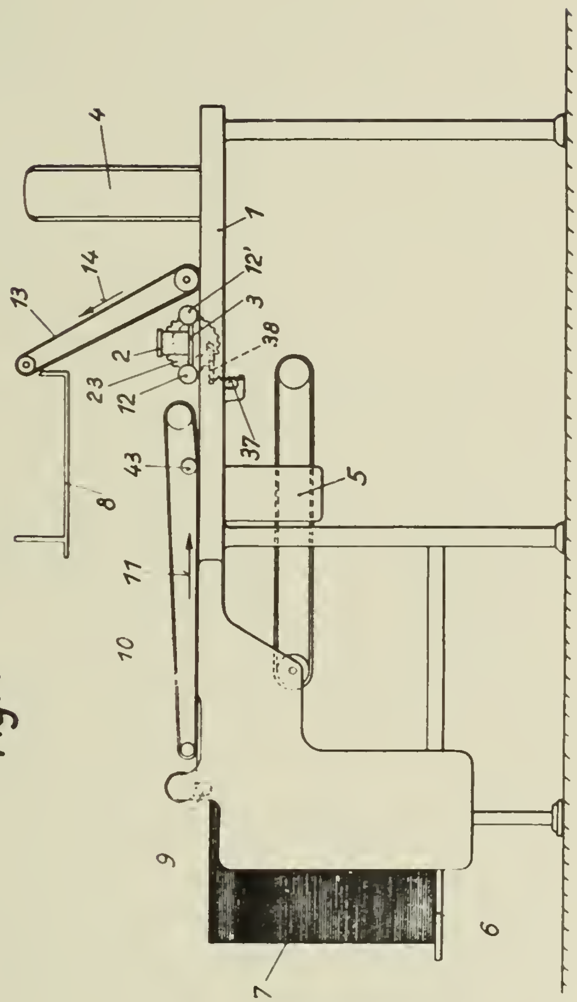


Fig. 1

Inventor:
J. Krell
by Glascock Downing & Seebold
Attorneys.

PUBLISHED

JUNE 15, 1943.

BY A. P. C.

J. KRELL

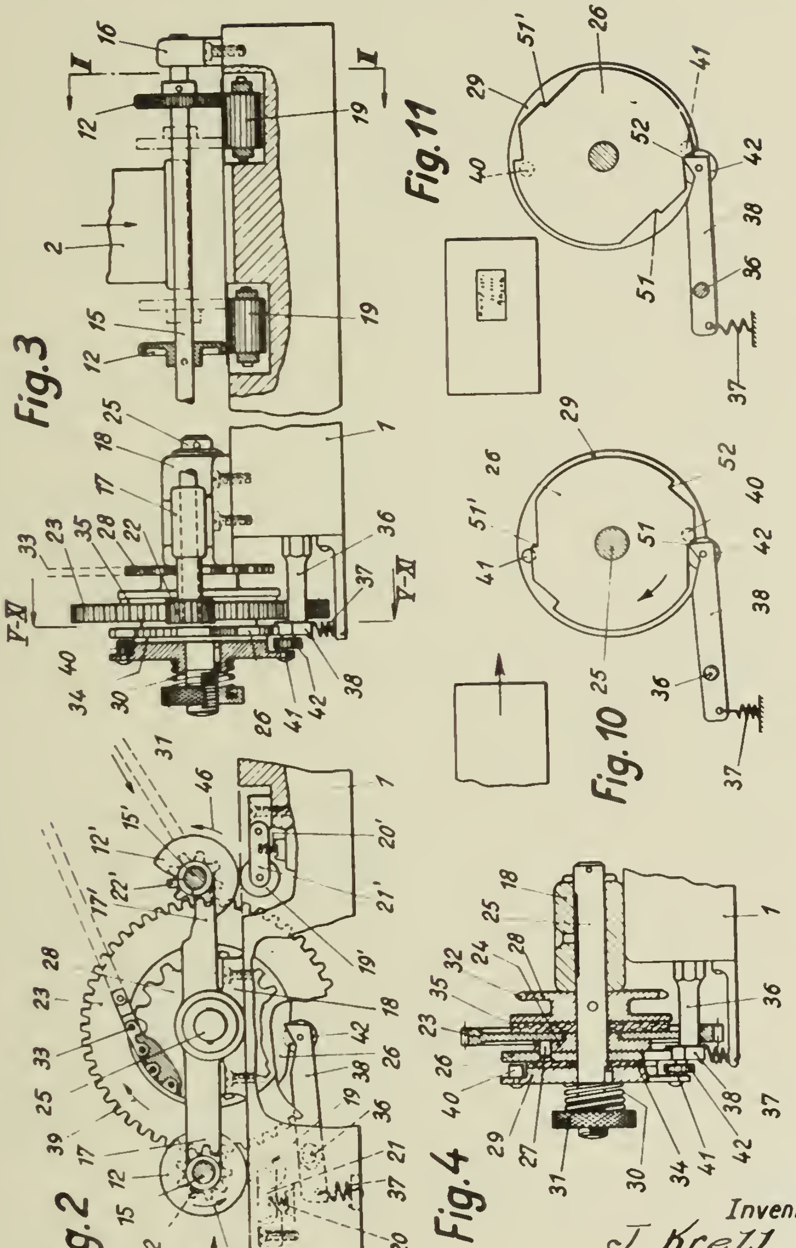
ADDRESS PRINTING MACHINE

Filed Dec. 21, 1939

Serial No.

310,443

3 Sheets-Sheet 2



Inventor:

J. Krell

by Glascock Downing & Seebold

Attorneys.

PUBLISHED

JUNE 15, 1943.

BY A. P. C.

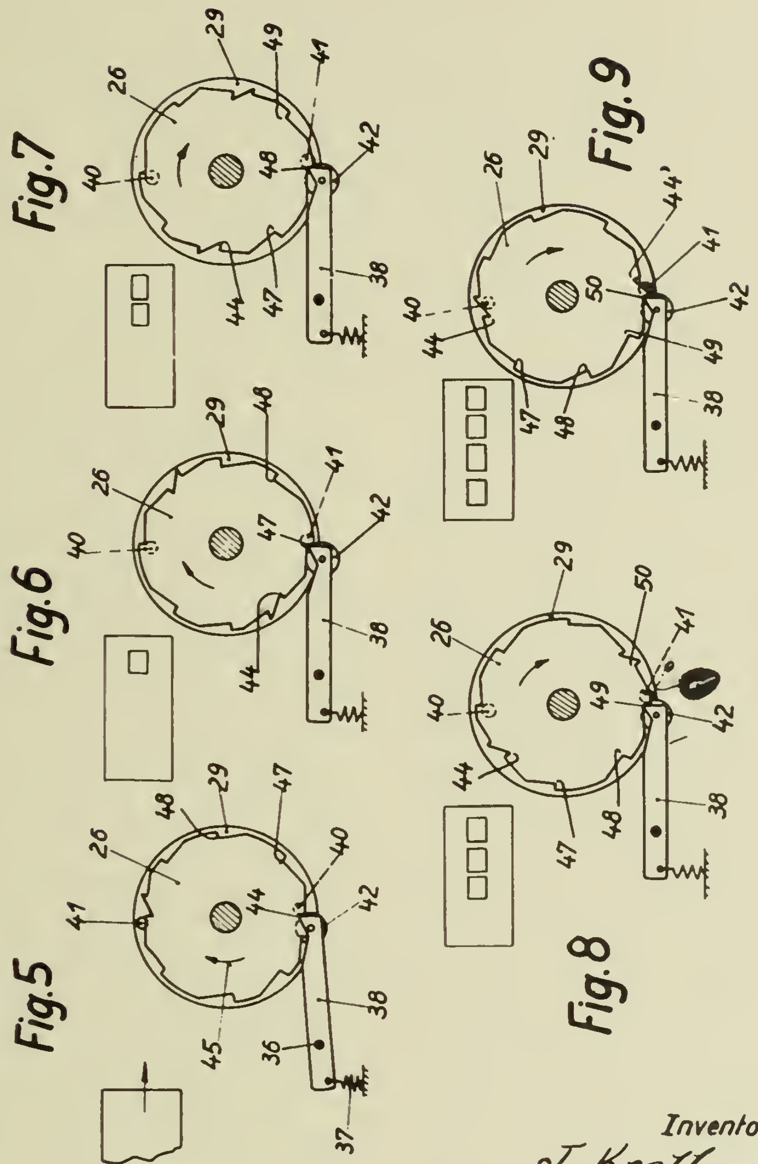
J. KRELL

ADDRESS PRINTING MACHINE

Filed Dec. 21, 1939

Serial No. 310,443

3 Sheets-Sheet 3



Inventor:
J. Krell

Glascock Downing & Seebold
Attorneys.

Published June 15, 1943 Serial No. 314,513

ALIEN PROPERTY CUSTODIAN

FILLING LIMITERS

Emile Piquerez, Saint-Cloud, France; vested in the Alien Property Custodian

Application filed January 18, 1940

Apparatus, called filling limiters, are already known which are adapted to stop the supply of a liquid to a tank when the level in the latter reaches a predetermined limit and which operate, at that instant, by means of a depression produced in a movable wall chamber by a trump through which the liquid current flows.

It is known, in this connection, that the depression produced by a trump is dependent on the velocity and, consequently, on the discharge rate of the liquid delivered.

On the other hand, in manipulating certain liquids, the velocity of flow has to be limited in order to avoid, either evaporation, or the formation of an undesirable emulsion. Furthermore, it is obvious that a trump which is designed for a small output is not suitable for a much larger output, without running the risk of creating an objectionable fall of pressure.

Consequently, hitherto, for satisfactory operation, an apparatus of this type provided with a given trump, could only be used for discharge rates between a predetermined minimum "*d*" and maximum D.

This involved the necessity, in order to meet all the requirements of industrial practice, of constructing a set of apparatus with gradually differing minimum and maximum discharge rates.

The present invention obviates this drawback inasmuch as it enables the interval between the minimum discharge rate "d" and the maximum D for a given apparatus to be extended, under such conditions that, theoretically, a single apparatus would be sufficient for usual industrial requirements and practically, only the concern of avoiding the use of too bulky an apparatus, in the case of a very small discharge rate, will lead to the construction of a plurality of apparatus instead of a single one.

For this purpose, in apparatus of the type referred to, that is to say provided with a valve for closing the supply of liquid, the closing of which is caused by a depression created by a pump in a movable wall chamber when the liquid reaches a predetermined level, the invention consists in the combination of said trump with another pipe which is connected to the liquid supply but which is closed, when inoperative, by a calibrated valve, in such a manner as constantly to give the trump a sufficient discharge rate, under a predetermined pressure, to perform its function, and to allow the excess discharge to flow directly into the tank, through said pipe, when said pressure is reached or exceeded.

Under these conditions, in spite of the variations of the discharge rate between very wide limits, the limiting of the level will be ensured in the tank which is being filled. This arrangement therefore enables an apparatus to be constructed which has a very large output and which will nevertheless retain all its sensitivity for very small outputs.

By way of indication and with the sole object of giving an idea of the possibilities provided by the present invention, it may be stated that it is possible to construct on these bases a limiting apparatus that operates for outputs of between 10,000 and 150 litres per hour for example, whereas hitherto a trump controlled apparatus designed for an output of 10,000 litres per hour could not operate when the output fell below 3,000 litres and an apparatus adapted to operate for a minimum output rate of 150 litres per hour could not be used for an output above 500 litres.

The accompanying drawings show, by way of example, three embodiments of the filling limiting apparatus according to the present invention.

Fig. 1 of said drawing is a longitudinal section of a first embodiment.

Fig. 2 is a longitudinal section of a second embodiment.

Fig. 3 is a partial section along A—A of Fig. 2.

Fig. 4 is a partial horizontal section along B—B of Fig. 2.

Fig. 5 illustrates a phase of the operation.

Fig. 6 shows a partial vertical section of a third embodiment.

In Fig. 1, 1 designates the main frame or body of the apparatus. In said frame is formed the seat 2 of the valve 3 for stopping the liquid current arriving through the nipple 1[a]. Said valve, which is loaded by a spring 4, is normally kept open, against the action of said spring, by a locking device adapted to be released by the movement of a diaphragm 5 when a suitable depression is produced in a chamber 6 of which said diaphragm forms one of the walls.

This locking device is formed, for example, by a lever 7, pivoted at 8, against which the stem of the open valve abuts and which is held in this position by a lock proper 9 pivoted at 10. A spring blade 11 holds this lock engaged and, on the other hand, presses it at the same time against the end of a rod 12 which is adapted to receive the action of the diaphragm 5. A push button 13 enables, if desired, the diaphragm to be operated by hand in order to swing the lock 9 and thereby cause the valve 3 to close.

On the other hand, an external lever 14 secured to a rotary cam 15 enables the lever 7 to be

lifted so as to return the valve to the open position after each automatic operation of the limiting device.

The chamber 6 communicates with the suction orifice 16 of a trump which comprises an injection nozzle 17 and a delivery nozzle 18 and is designed only to operate when the orifice of said delivery nozzle is immersed. The injection nozzle 17 constantly communicates with the liquid chamber 19 formed after the seat 2 of the valve 3. A small duct 20, which separately places the chamber 6 in communication with the atmosphere of the tank being filled, enables air to return into the chamber 6 in the event of the trump's producing an unexpected suction in said chamber, for example when an air pocket bursts at the outlet of the injection nozzle 17.

This system is, by construction, adapted to produce the closing of the valve 3 when the trump, through which a current is flowing at a predetermined speed v is immersed.

According to the invention, the trump is combined with a pipe 21 which preferably has a much larger passage cross-section, and which extends between the liquid chamber 19 and the tank to be filled, said pipe being closed, when inoperative, by a valve 22 which is loaded by a spring 23 in such a manner as only to open under a pressure equal to or greater than the pressure p corresponding to the velocity v for which the trump is adapted to fulfil its function.

Under these conditions, the trump has a priority of discharge with respect to the pipe 21 which opens to allow the excess discharge to flow towards the tank only when the pressure in the chamber 19 is greater than p. Consequently, the operation of the limiting device is ensured for all values of the discharge rate greater than that which corresponds to p, the upper limit of utilization of the apparatus depending only on the cross-section given to the pipe 21.

It is advantageous, as shown in the drawing, in order to avoid having to use a trump of great length, to surround same and the pipe 21 with a cylindrical casing 24 which enables the filling level to be brought substantially to the level of the lower orifice 24^a of said casing. As soon as said orifice is closed by the rising liquid, the air in the casing is driven through said liquid by the jet issuing from the trump. The liquid then rises almost instantly up to the lower orifice of the delivery nozzle 18 and the trump sucks in the chamber 6 and causes the valve 3 to close. The rapidity of the operation is such that at this instant, the level in the tank has only risen a negligible amount above the plane of the orifice 24^a.

Said casing also enables the position of the apparatus to be ensured by guiding in the filling nipple of the tank to be filled. The insertion may be limited by an adjustable stop 25 which enables the filling level to be fixed by fixing the position of the orifice 24^a relatively to the tank.

As stated, it is possible, by means of the invention, to construct an apparatus which is adapted to operate for discharge rates varying for example from 150 to 10,000 litres per hour and which consequently meets most of the usual requirements. The upper limit of such an apparatus could, moreover, be raised above 10,000 litres per hour; but it will be understood that in that case the bulk of the apparatus would be such as to make its use illogical in the case of discharge rates in the region of the lower limit.

In the embodiment of Figs. 2 to 4, the same reference numerals designate the same members. The tube formed by the trump 17^1—18^1 and its extension 30 is in this case included in a cylindrical pipe 31, the remainder of the cross-section of which forms a pipe 21^1 which performs the function of the pipe 21 of Fig. 1. The trump discharges into the tank through the orifice 32 provided in the casing 24^1 and communicating with the extension 30. The filling level is substantially on a level with the upper edge s of said orifice 32. The valve 22^1 for closing the pipe 21^1 is in this case arranged in the lower part of said pipe which can discharge into the tank to be filled, when the valve is open, through the lateral orifices 34 of the casing 24^1. An adjustable stop, not shown, is mounted on the casing 24^1 as in the case of Fig. 1.

As in the previous case, the suction orifice of the trump communicates with the chamber 6 provided with a diaphragm 5.

The device for locking and releasing the valve 3 is in this case advantageously formed by a cam which is adapted to be operated rotatably from the outside and against which the stem of the valve abuts in the open position, said cam being connected to the diaphragm in such a manner as to move parallel with itself and allow said stem to escape, thereby to enable the valve to close when the depression causes the diaphragm to move.

The rod 35, which can be moved by the diaphragm 5, carries the cam 36, the position of which behind the stem 3^a of the valve 3 is determined by the abutment of a shoulder 35^a against an inner wall of the frame. The extension 35^b of the rod 35 is engaged in a bore 37 of an operating key 38 which is adapted to drive the cam by means of a projection 39 secured to said cam and engaged in another bore or recess 40 of the key. In Fig. 2, said projection, which is assumed to have been brought into the plane of the figure, has been drawn in chain dotted lines. A spring 41 tends to hold the cam constantly in its above defined position, behind the stem of the valve.

On the key 38, outside the apparatus, is pinned a knob 42 provided with a ball 43 and with a spring 44 for resiliently engaging with a fixed cage 45 so as to form a mark for the user.

A spring 46 with flat convolutions, ensures fluid-tightness by pressing the key 38 against a gasket 47.

The device being in the position of Figs. 2 and 3, the valve 3 is open and its stem abuts against the cam 36. The ball 43 is engaged in the groove 45^1 of the cage 45.

It will be readily understood that when the diaphragm moves towards the left of Fig. 2, responsive to the depression, it will also move the cam 36 towards the left by compressing the spring 41 and consequently said cam will allow the stem 3^a of the valve to escape, enabling the latter to close by the action of the spring 4 (Fig. 5). At this instant, the cam will be held in its new position by the actual stem of the valve against which the projection of the cam abuts under the pressure of the spring 41.

For resetting the apparatus, that is to say for opening the valve 3 again, it suffices to operate the cam 36 rotatably by means of the knob 42. Starting from the position of Fig. 5, it will be understood that after a half-revolution, the projection of the cam will have escaped from the stem of the valve 3, and consequently the spring 41 will be able to move said cam in the axial direction and return it to the plane of the stem 3^a. Consequently, by continuing the rotation for a further half-revolution, the valve

3 will be lifted by the projection of the cam, and the engaging ball of the knob **42** will fall into the groove **45**^{1} and inform the operator that said valve is open.

In the embodiment of Fig. 6, the conduit formed by the trump and the conduit controlled by the loaded valve are concentric.

The trump **17**^{2}—**18**^{2} is arranged in the axis of a tube **50** through which the liquid coming from the inlet chamber **19** flows down. Its suction orifice communicates with the depression chamber **6**, for example through two series of small ducts **51** and **52**, the first bored in radial arm **53**^{a} of a tubular part **53** secured to the delivery nozzle **18**^{2}, and the second in a sleeve **54** connecting the part **53** to the frame **1** of the apparatus.

In the part **53** are screwed a tube **30**^{1} which extends the trump like the pipe **30** of Fig. 2, and a tube **21**^{2}, concentric with the former, which performs the function of the pipe **21** of Fig. 1, or **21**^{1} of Fig. 2, and which at the same time acts as a guide for placing the apparatus in position on the tank to be filled. The seat of the valve **22**^{2} that controls the flow of the liquid through the pipe **21**^{2}, is in this case formed at the lower end of the tube **50**. The valve **22**^{2} is of annular shape and is adapted to slide without play on a tubular extension **55** of the injection nozzle **17**^{2}. In its closed position it is flush with the liquid inlet orifice of said injection nozzle.

It will be understood that, without any other arrangement, the jet of liquid flowing from the large pipe **21**^{2} would be liable to isolate the central pipe **30**^{1} from the atmosphere of the tank and consequently, the trump might operate prematurely.

In order to avoid this possibility, it suffices to set up a communication, through the annular jet of liquid falling from the pipe **21**^{2}, between the pipe **30**^{1} and the atmosphere of the tank, for example by means of inverted gutters **56** fixed at the bottom of the tube **30**^{1} which is provided with registering recesses **57**. The filling level will in this case be established substantially in the plane of the top of said recesses.

It is obvious that the invention is not limited to the embodiments described and illustrated and that it includes all the modifications of same based on the same principles.

EMILE PIQUEREZ.

PUBLISHED
JUNE 15, 1943.
BY A. P. C.

E. PIQUEREZ
FILLING LIMITERS
Filed Jan. 18, 1940

Serial No.
314,513
4 Sheets-Sheet 1

Fig. 1

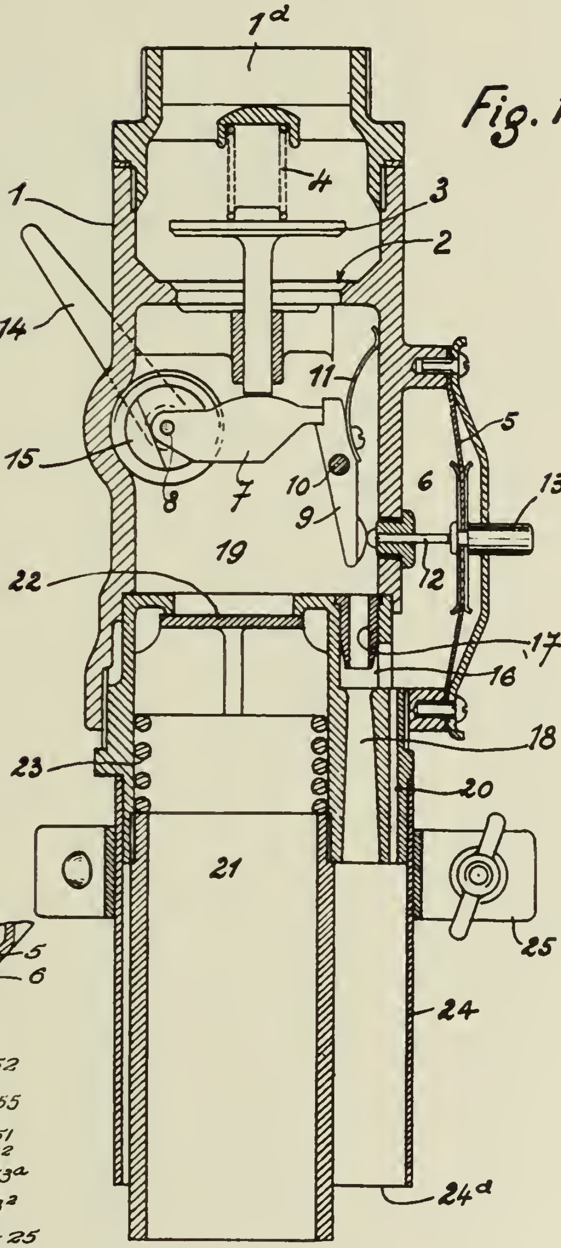
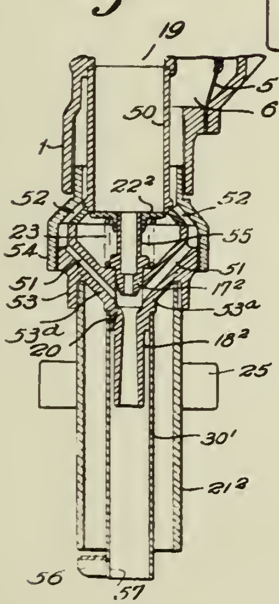


Fig. 6



Inventor
Emile Piquerez
By Sommers & Young
Attys

PUBLISHED
JUNE 15, 1943.
BY A. P. C.

E. PIQUEREZ
FILLING LIMITERS
Filed Jan. 18, 1940

Serial No.
314,513
4 Sheets–Sheet 2

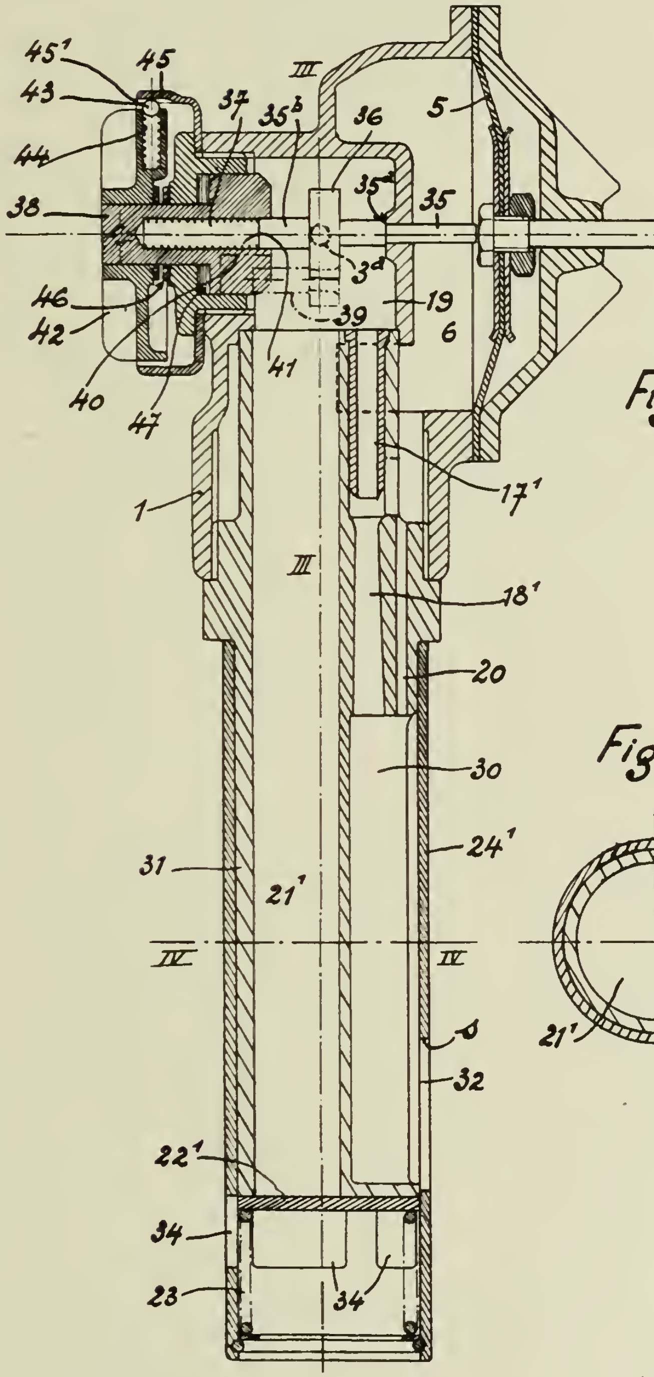
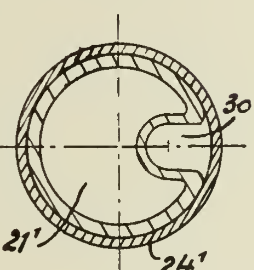


Fig. 2

Fig. 4



Inventor
Emile Piquerez
By Sommers & Young Attys

PUBLISHED
JUNE 15, 1943.
BY A. P. C.

E. PIQUEREZ
FILLING LIMITERS
Filed Jan. 18, 1940

Serial No.
314,513
4 Sheets-Sheet 3

Fig. 3

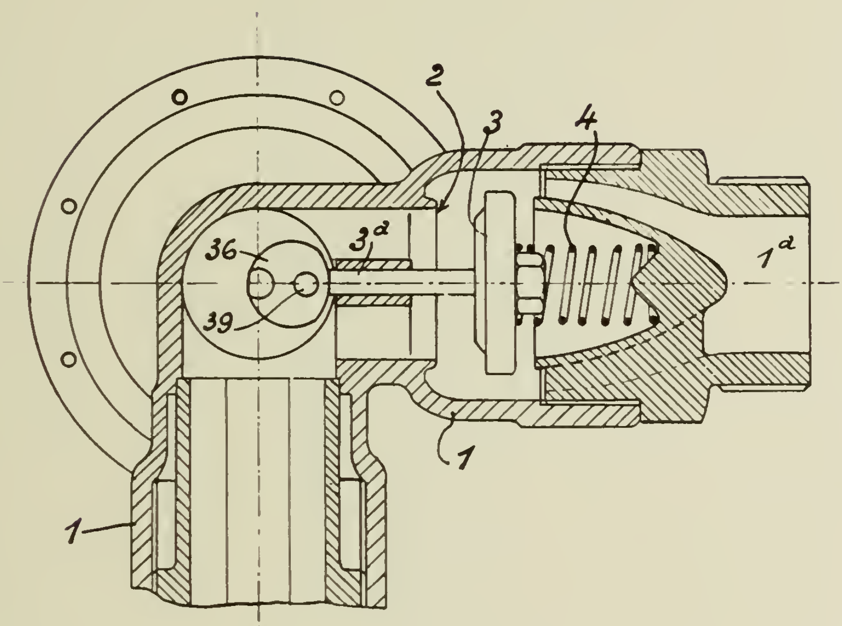
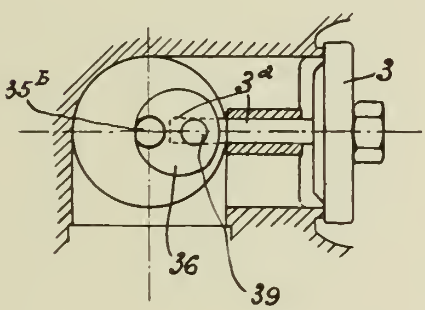


Fig. 5



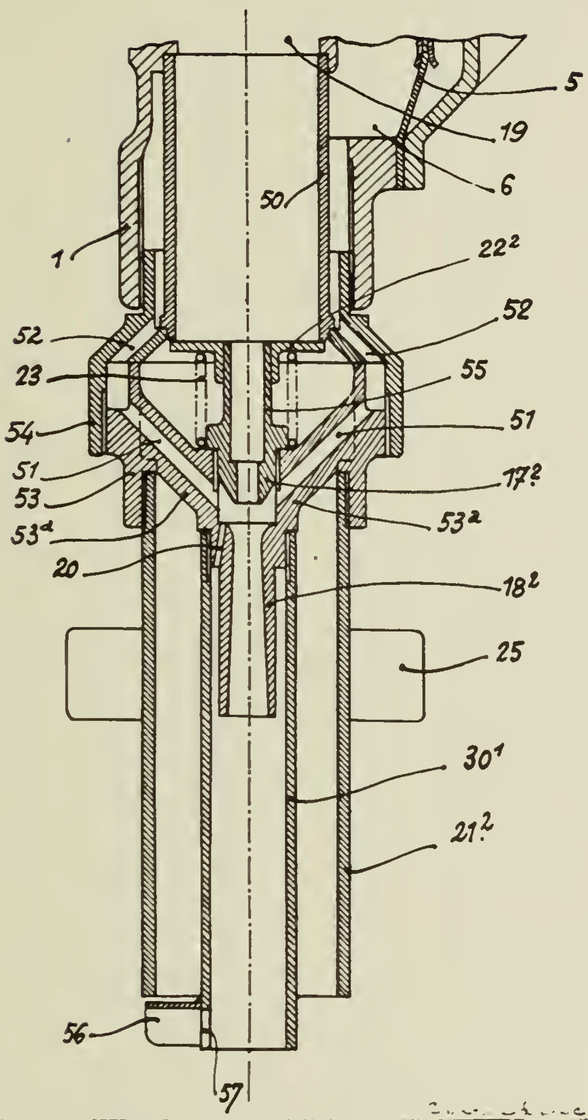
Inventor
Emile Piquerez
By Sommers & Young
Att'ys

PUBLISHED
JUNE 15, 1943.
BY A. P. C.

E. PIQUEREZ
FILLING LIMITERS
Filed Jan. 18, 1940

Serial No.
314,513
4 Sheets-Sheet 4

Fig. 6



Inventor,
Emile Piquerez
By Sommers & Young
Attys

Published June 15, 1943

Serial No. 318,000

ALIEN PROPERTY CUSTODIAN

DEVICE FOR DIRECTING AND CALCULATING APPARATUS

Karl Papello and Willy Sander, Jena, Germany; vested in the Alien Property Custodian

Application filed February 8, 1940

Devices for displacing a body according to the movement of another body of variable speed, as employed in connection with directing and calculating apparatus, are known which are on the one hand equipped with a speed changing gear connected with a source of energy and where the driven shaft of said speed changing gear is coupled with the body to be displaced and which, on the other hand, contain a control gear coupled with the adjusting device of the speed changing gear as well as with the body to be displaced, so that the latter can be simultaneously and directly actuated by the said source, via the speed changing gear, and by the control gear and that every alteration in the angular speed imparted to the object body via the speed changing gear results in an additional displacement of the object body. Devices of this kind are very well suitable, for instance, for following up aircraft with the aid of hand-controlled sighting telescopes or for the tele-control of bodies with the aid of a transmitting and receiving system where the speed of the bodies to be displaced is relatively low, while the said devices are less satisfactory where a higher speed of displacement is required.

According to the present invention devices of the said kind are obtained, i. e. devices which may be less satisfactory for lower speeds, but excellent for higher speeds of displacement, if means influenced by the control gear are provided for the purpose of altering the angular speed of the speed changing gear driving shaft in accordance with the changes the angular speed of the driven shaft of the speed changing gear experiences under the action the control gear exerts upon the adjusting device. If the adjustability of the speed changing gear is required to be such that its power-driven shaft is to rotate in both directions, provision would have to be made to the effect that the action of the control gear upon the driving shaft of the speed changing gear be reversed at the moment when the driven shaft changes its direction of rotation. Towards this end a mechanical or electrical contrivance could be employed with advantage.

In the new devices as suggested, same as in the known devices of the aforesaid kind the action exerted by the control gear upon the adjusting device is such that the displacement effected by the adjusting device during the action of the control gear and the change thereby effected in the angular speed of the driven shaft of the speed changing gear are preserved when the aforesaid action ceases. There are two possibilities however of producing an action of the control gear upon the driving shaft of the speed changing gear, both possibilities leading to useful devices. The said action can either be of such a nature that the angular speed of the driving shaft remains the same after the action of the control gear has ceased, or of such a nature that after the cessation of the control gear action the angular speed differs from the angular speed before such action by an amount depending upon that action.

For the first of these two cases a simple solution is arrived at by coupling the driving shaft of the speed changing gear with the source of energy and with the control gear by means of a differential.

For the second case a suitable solution is arrived at if provision is made for a second speed changing gear whose driving shaft is in connection with the source of energy and whose driven shaft in connection with the driving shaft of the other speed changing gear, while its adjusting device is coupled with that of the other speed changing gear for common adjustment.

Devices according to both of the aforementioned instances can be used for displacing a body in accordance with the movement of the receiver of an electric tele-transmitting system. In doing so the provision is recommended of a follower mechanism of whose two mutually adjustable parts one is in a known fashion coupled with the body to be displaced and the other with the receiver, the purpose of the follower mechanism being to operate the adjusting device of the speed changing gear when a difference should arise between the speed of these two parts, and to change the angular speed of the driving shaft of that gear. A useful model of a similarly designed device is obtained if provision is made for two clutch couplings, by means of which the source of energy can be brought to act upon the adjusting device of the speed changing gear in one or the other sense, as well as for two electromagnets each of which is to operate one of the two clutch couplings, and furthermore, if provision is made for electrical means to render operative one or the other of the two electromagnets when the relative speed between the mutually adjustable parts of the follower mechanism should experience an increase or a reduction, and thus, by means of the respective clutch coupling operate the said adjusting device in such a manner that the angular speed of the speed changing gear driving shaft is accelerated or retarded.

If the source of energy is equipped with a reg-

ulating device means can be usefully provided for causing the control gear to act upon this regulating device in such a manner that the angular speed of the shaft of the said source changes in the same sense as does the angular speed of the driven shaft of the speed changing gear under the influence the control gear exerts upon the adjusting device of the speed changing gear. In this connection the action of the control gear upon the regulating device of said source is governed by the corresponding conditions as apply in the aforementioned action of the control gear upon the driving shaft of the speed changing gear, i. e., the said action can either be of such a nature that the angular speed of the shaft of said source after the control gear has ceased to operate is the same as before said operation, or of such a nature that after the cessation of the control gear action the angular speed differs from the angular speed prior to such control gear action by an amount depending upon such action.

If the device is intended for displacing a body in accordance with the movement of the receiver of an electrical tele-transmitting system a useful solution is arrived at in the first of said two cases by the provision of a follower mechanism of whose two mutually adjustable parts one is in a known fashion coupled with the body to be displaced and the other with the receiver, as well as by the provision of two clutch couplings by means of which the source of energy can be caused to act in one or the other sense upon the regulating device of the speed changing gear, furthermore, by two electro-magnets, each of which serves for operating one of the two clutch couplings, and by the provision of electrical means to render operative one or the other of the two electro-magnets when the relative speed between the said two parts of the follower mechanism experiences an increase or reduction and thus, by means of the respective clutch coupling act upon the regulating device of the power-source in such a manner that the angular speed of the shaft of said source changes in the same sense as does the angular speed of the driven shaft of the speed changing gear under the influence the follower mechanism exerts upon the adjusting device of the speed changing gear.

The new devices as described in the aforegoing and which, as pointed out before, only give satisfactory results where the bodies in question are to be displaced at high speeds, can be still further so improved that they are well suited also for lower displacing speeds in that,—similar as in the case of the known gears of the aforementioned kind—the control gear is so coupled with the body to be displaced that the latter during the operation of the control gear is additionally displaced.

In the accompanying drawing diagrammatical illustrations are given of seven constructional examples of a device according to the invention. In Figs. 1, 2, 3 and 4 directing apparatus are illustrated for following up an aircraft by means of a sighting telescope, and in Figs. 5, 6 and 7 devices for adjusting a body in accordance with the movement of the receiver of an electrical tele-transmitting system.

The directing apparatus according to Fig. 1 embodies a sighting telescope **1** which, by means of a worm gearing **2**, is actuated through a shaft **3** which, with the aid of a clutch coupling **4**, can be coupled with the driven shaft **5** of a speed changing gear. The latter is a friction gearing containing a friction disc **6** and a friction wheel **7**. The friction wheel **7** is disposed displaceably along the shaft **5** which is provided with a groove. A spindle **9** which is actuated by means of hand wheel **8** and which, by means of a thread, engages a carrier **10** for the friction wheel **7**, serves for displacing this wheel. The carrier **10** is provided with a pin **11** engaging in a slot **12** of arm **13** of a triple arm lever. This lever is pivotally mounted around a permanent pin **14** in such a way that it experiences a rotation about the axis of pin **14** when the carrier **10** is displaced by the manipulation of hand wheel **8**. Each of the two other arms **15** and **17**, of the said lever is fitted with a pin **16** and **18**, respectively. Pin **16** cooperates with a lever **19** pivotally mounted around a permanently disposed pin **20**. The lever **19** does not experience any rotations about the pin **20**, unless the carrier **10** moves in such a manner that the friction wheel **7** occupies positions between its central position, as illustrated in the drawing, where it touches the centre of the friction disc **6** and that respective end position where it touches the left edge of the friction disc **6**. By means of spring **21** the lever **19** is held in engagement with the pin **16** until it lies against a permanent arresting stop **22**, which will be the case when the friction wheel **7** occupies its central position. The pin **18** cooperated with a lever **23** which is pivotally disposed around a permanently fitted pin **24**. The lever **23** does not experience any rotations about the pin **24**, unless the carrier **10** moves in such a manner that the friction wheel **7** occupies positions between its central position and that respective end position where it touches the right edge of the friction disc **6**. By means of a spring **25** the lever **23** is held in engagement with the pin **18** until it lies against a permanent arresting stop **26**, which will be the case when the friction wheel **7** occupies its central position. With the lever **19** is firmly connected a bevel gear **27** meshing with a bevel gear **28**. With the lever **23** a bevel gear **29** meshing with a bevel gear **30** is firmly connected. By means of a shaft **31** as well as by a pair of bevel gears **32** and by a shaft **33** the rotations of the bevel gear **28** are imparted to a crown wheel **34** of a differential **35** whose other crown wheel **36**—by means of a shaft **37** by a pair of bevel gears **38** and by a shaft **39**—is coupled with the bevel gear **30** in such a way that the planet pinions **40** of the differential **35** with equal and opposite displacements of the friction wheel **7** from its central position, are rotated by equal amounts and in the same rotational sense about the coinciding axes of the crown wheels **34** and **36**. For driving the friction gearing **6**, **7** a motor **41** having a constant number of revolutions is provided for which actuates the one crown wheel **42** of a differential **43** whose other crown wheel **44** is disposed on the shaft **45** of the friction disc **6**. The differential **43** is so coupled with the differential **35** that with displacements of friction wheel **7** out of the centre of friction disc **6** the crown wheel **44** is rotated in the same sense as by the motor **41**. For this purpose a pair of bevel gears **46**—which are intended to impart to the planet pinions **47** of the differential **43** a rotation about the coinciding axes of the crown wheels **42** and **44**—by means of three shafts **49**, **50** and **51** and two pairs of bevel gears **52** and **53** is coupled with a pair of spur wheels **48** intended to impart to the planet pinions **40** of the differential **35** a ro-

tation about the coinciding axes of the crown wheels **34** and **36**.

In use the telescope **1**—with disengaged clutch coupling **4**—is to be pointed to the aircraft to be followed. This done, the clutch coupling **4** is to be engaged and the telescope **1** kept pointed to the aircraft by manipulating the hand wheel **8**.

The directing apparatus according to Fig. 2 differs from that shown in Fig. 1, merely by omission of differential **43**. To the friction gearing **6**, **7** is coordinated a second friction gearing whose friction disc **54** is driven by the motor **41** and whose friction wheel **55** is disposed on the shaft **45** of the friction disc **6**. The shaft **45** is provided with a groove. The carrier **56** for the friction wheel **55** is actuated by a spindle **57** with left handed thread, which is driven by a pair of bevel gears **58** coupled with the shaft **49** in such a manner that the friction wheel **55**—with displacements of the friction wheel **7** out of the centre of the friction disc **6**—experiences a displacement out of the centre of friction disc **54** towards that particular edge of said friction disc adjoining the friction disc **6**.

The difference between the effects of the two described apparatus is that in the apparatus according to Fig. 1, the angular velocity of shaft **45** of the friction disc **6** is invariably the same when the hand wheel **8** is idle, while in the case of the apparatus according to Fig. 2 a certain definite angular velocity of shaft **45** is alotted to each position of the hand wheel **8**.

Classified according to effect the apparatus shown in Fig. 3 belongs to the type shown in Fig. 2. It differs from the latter mainly by the omission of the second friction gearing **54**, **55** and by a motor **59** with regulatable number of revolutions being provided to drive the friction disc **6**. This motor is provided with a rheostat **60** connected in front of the armature winding. A sliding contact **61** displaceable relative to said rheostat is attached to a female carrier **62** which engages a threaded spindle **63** and is guided parallel to said spindle. The spindle **63** is coupled with spindle **9** by means of a pair of bevel gears **64**. In the centre position of friction wheel **7** as shown in the drawing, where the friction wheel touches the centre of the friction disc **6**, the sliding contact stands in the centre between the two ends A and B of the rheostat **60**. Both ends A and B are conductively connected with the one armature terminal K_1 of the motor **59**. The other armature terminal K_2 is in connection with the one wire of a circuit **65** whose other wire is connected with the sliding contact **61**, the result of this arrangement being that every displacement of the friction wheel **7** out of the centre of the friction disc **6**—irrespective whether this takes place towards the right or to the left—brings about an increase in the number of revolutions of the motor **59**.

The apparatus as shown in Fig. 4 and which according to effect, belongs to the type of apparatus according to Fig. 1, differs from the latter only in a differential **66** being interposed between clutch coupling **4** and the grooved shaft **5**. One of the crown wheels, **67**, of the said differential is mounted upon shaft **5**, while the other crown wheel **68** is fitted to shaft **69** supporting one section of clutch coupling **4**. By means of a pair of spur gears **71** the planet pinions **70** of the differential **66** are so coupled with the spindle **9** that the angular velocity of shaft **69** is greater than that of the grooved shaft **5** when a displacement of the friction wheel **7** out of the centre of the friction disc **6** takes place.

The device according to Fig. 5 serves for adjusting a member **72** according to the adjustments of the receiver **73** of an electric tele-transmitting system. Those parts of the said device which are identical with those of the apparatus according to Fig. 1 are designated same as the latter. The member **72** is disposed on a shaft **74** which is coupled with the driven shaft **5** of the friction gearing **6**, **7** by means of a pair of bevel gears **75**. Shaft **5** carries the one member **76** of a following device whose other member **77** is mounted on the receiver **73**. Via a slip ring arrangement **78** and a circuit **79** the following device **76**, **77** controls a reversing motor **80** in such a manner that, with an acceleration of the member **77** relative to the member **76**, it runs in one direction and, when retarded, in the other, while it is at rest when the two members are in uniform movement. The motor **80** is coupled with the spindle **9** by means of two shafts **81** and **82** and of two pairs of bevel gears **83** and **84**. A reversing motor **85** serves for driving the pair of bevel gears **46** to give the planet pinions **47** of the differential **43** a rotation about the coinciding axes of the two crown wheels **42** and **44** and an additional rotation therefore to the shaft **45** driven by motor **41**. The reversing motor **85** is required to alter its sense of rotation on the one hand when changing between the acceleration and retardation of the member **77** reltive to the member **76** takes place, and on the other, when in its displacement relative to the friction disc **6** the friction wheel **7** passes through the centre of the friction disc **6**.

To satisfy this requirement the following arrangement is provided for. On a permanently disposed disc **66** an annular copper strip **87** and an annular insulating strip **88** are arranged in such a manner that both strips form a complete ring. Said ring and a contact lever **89** rotatable about the axis of said ring form a switching device. The contact lever **89** is so attached to a worm gear (not shown in the drawing) meshing with a worm **90** fitted to the shaft **81** that it coincides at the point of contact between the two strips **87** and **88** when the friction wheel **7**, as shown in the drawing, touches the centre of friction disc **6**. The described switching device is so connected with the circuit **79** and with two electromagnets **91** and **92** that the magnets—according to whether the contact lever **89** touches the copper strip **87** or the insulating strip **88**—are charged with current or are dead. The magnets **91** and **92** cooperate with the contact levers **93** or **94**, respectively, each of which is pivotally disposed around a permanently fitted pin **95**, or **96**, respectively, and each of which is subjected to the action of a spring **97**, or **98**, respectively, counteracting the respective magnets. Depending upon whether the magnet **91** carries current or not the contact lever **93** closes a contact **99** or **100** and, depending upon whether the magnet **92** carries current or not, the contact lever **94** closes a contact **101** or **102**. The contact levers **93** and **94**, as well as the contacts **99**, **100**, **101** and **102**, the reversing motor **85** and the slip-ring arrangement **78** are so connected by electric wires that the aforesaid requirement is satisfied.

The devices according to Figs. 6 and 7 are intended for the same purpose as the device according to Fig. 5. They differ from the latter by the controlling gear being of another design, one motor only being required for operation. For the sake of simplicity the sense of rotation of

the receiver 73 has been assumed to remain the same for both of the devices. What is required therefore is that the friction wheel is adjusted relative to the friction disc 6 merely between the centre and the one edge of the latter so that the device provided for in Fig. 5, viz., for changing the rotational sense of the additional rotation of the friction disc 6 in connection with the position of the friction wheel 7 relative to the friction disc 6 can be dispensed with. The designations of Fig. 5 have been maintained as far as possible.

In Fig. 6 the pair of bevel gears 46 is coupled with the spindle 9 by means of two shafts 103 and 104, as well as by two pairs of bevel gears 105 and 106. On the shaft of the motor 41 a bevel gear 107 meshing two bevel gears 108 and 109 is mounted. The bevel gear 108 is mounted on a shaft 110 carrying the fixed part of a clutch coupling 111. The movable part of this clutch coupling is guided on a shaft 112 by means of slot and key. The one arm 113 of a two-arm lever pivotally mounted around a permanent axis engages a ring groove of the said movable part, while the other arm 114 is subjected to the action of a spring 115 which tends to hold the lever 113, 114 in that respective position where the clutch coupling 111 is disengaged. Co-acting with the arm 114 is a magnet 116 which when exited overcomes the tension of the spring 115 and brings the lever 113, 114 into that respective position where the clutch coupling engages. With the one coil-end the magnet 116 is connected to the slip-ring arrangement 78 and with the other coil-end to a pocket-lamp battery 117 which is likewise in connection with the slip-ring arrangement 78. The magnet 116 is exited when the member 77 accelerates relative to the member 76 of the follower mechanism. By means of a pair of bevel gears 118 as well as of a shaft 119 and of a pair of bevel gears 120 the shaft 112 is so coupled with the spindle 9 that the carrier 10—with the clutch coupling 111 engaged—experiences a displacement in the direction of the arrow as shown in the drawing, whereby as a result of the spindle 9 being coupled with the pair of bevel gears 46 the crown wheel 44 of the differential 43 experiences a rotation in the same sense as under the effect of the motor 41. The bevel gear 109 is mounted upon a shaft 121 carrying the fixed part of a clutch coupling 122. The movable part of this clutch coupling is keyseated on a shaft 123. The one arm 124 of a two-arm lever pivotally mounted around a permanent axis engages a ring groove of the said movable part, while the other arm 125 is subjected to the action of a spring 126 which tends to hold the lever 124, 125 in that respective position where the clutch coupling 122 is disengaged. Co-acting with the arm 125 is a magnet 127 which when excited overcomes the tension of a spring 126 and brings the lever 124, 125 into that respective position where the clutch coupling is engaged. With the one coil-end the magnet 127 is connected to the slip-ring arrangement 78 and with the other coil-end to the pocket lamp battery 117. The magnet is excited when the member 77 is retarded relative to the member 76 of the following mechanism. By means of four pairs of bevel gears 128, 129, 130 and 131, as well as by three shafts 132, 133 and 134 the shaft 123 is so coupled with the spindle 9 that the carrier 10—with clutch coupling 122 engaged—experiences a displacement in a direction opposite to that indicated by the arrow in the drawing.

The device according to Fig. 7 mainly differs from that shown in Fig. 6 by the omission of the differential 43 and by the number of revolutions of the motor 41 being regulatable. The shaft of motor 41 carries the friction disc 6. The motor 41 is equipped with a rheostat 135 in front of the armature and with a rheostat 136 in front of the field winding. The arm 113 of the lever 113, 114 co-acts with a switch 137 in such a manner that with the switch 137 open the armature current flows through the rheostat 135, while, with the switch 137 being closed, the rheostat 135 is short-circuited, involving an increase in the angular speed of the shaft of motor 41. The closing of the switch 137 takes place simultaneously with the engaging of clutch coupling 111, i. e., when the member 77 accelerates relative to the member 76 of the follower mechanism. The arm 124 of lever 124, 125 cooperates with a switch 138 in such a manner that, with the switch 138 open, the exciting current flows through the rheostat 136, while with the switch 138 closed, the rheostat 136 is short-circuited, involving a reduction in the angular speed of the shaft of motor 41. The closing of the switch 138 takes place simultaneously with the engaging of the clutch coupling 122, i. e., when the member 77 is retarded relative to the member 76 of the follower mechanism.

KARL PAPELLO.
WILLY SANDER.

PUBLISHED

JUNE 15, 1943.

BY A. P. C.

K. PAPELLO ET AL
DEVICE FOR DIRECTING AND
CALCULATING APPARATUS
Filed Feb. 8, 1940

Serial No.
318,000

6 Sheets-Sheet 1

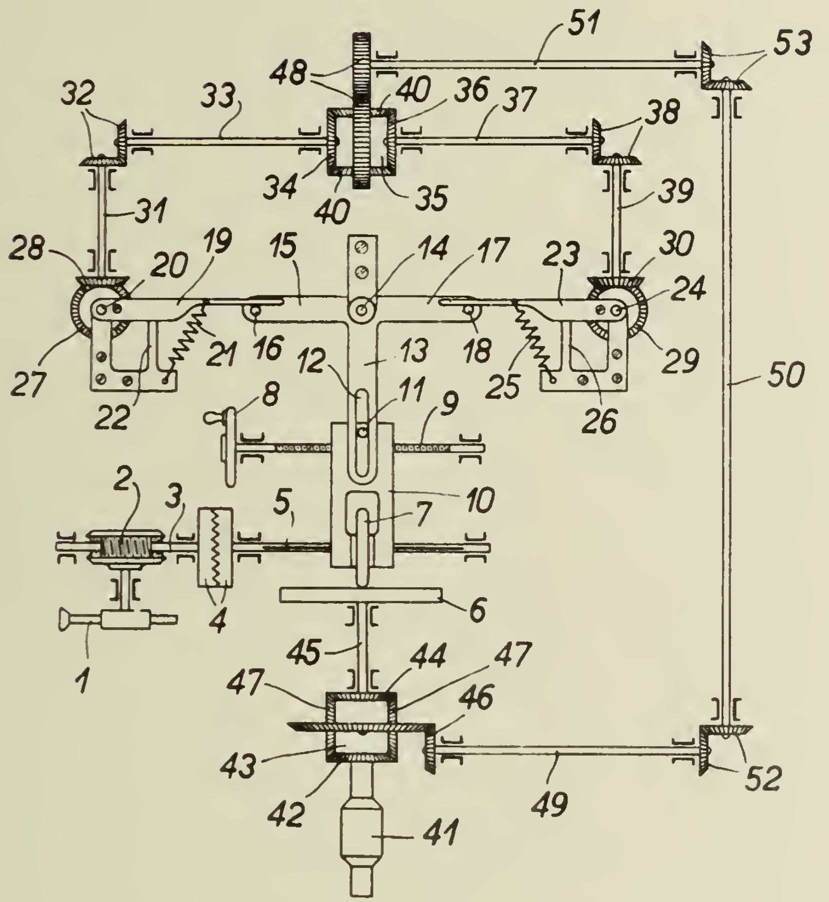


Fig. 1

Inventors:
Karl Papello

PUBLISHED

JUNE 15, 1943.

BY A. P. C.

K. PAPELLO ET AL

DEVICE FOR DIRECTING AND CALCULATING APPARATUS

Filed Feb. 8, 1940

Serial No. 318,000

6 Sheets-Sheet 2

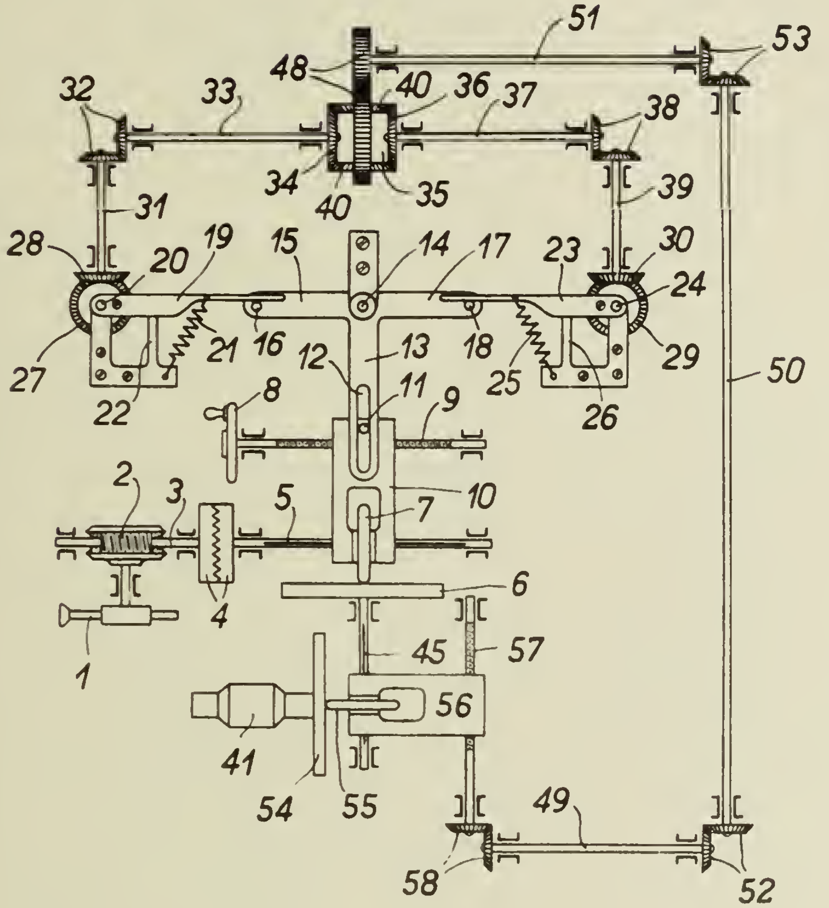


Fig. 2

Inventors:

Karl Papello

PUBLISHED
JUNE 15, 1943.
BY A. P. C.

K. PAPELLO ET AL
DEVICE FOR DIRECTING AND
CALCULATING APPARATUS
Filed Feb. 8, 1940

Serial No.
318,000

6 Sheets-Sheet 3

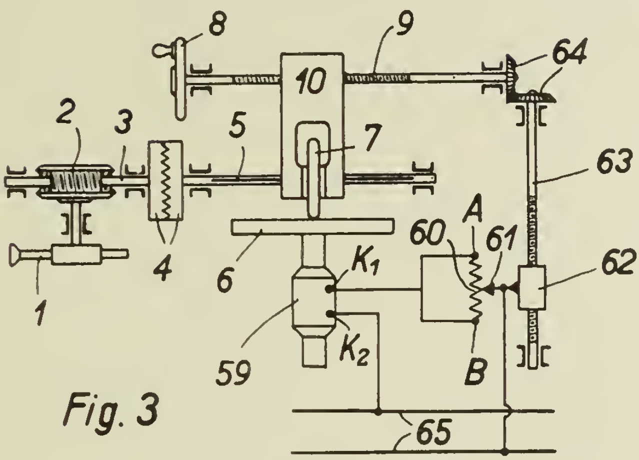


Fig. 3

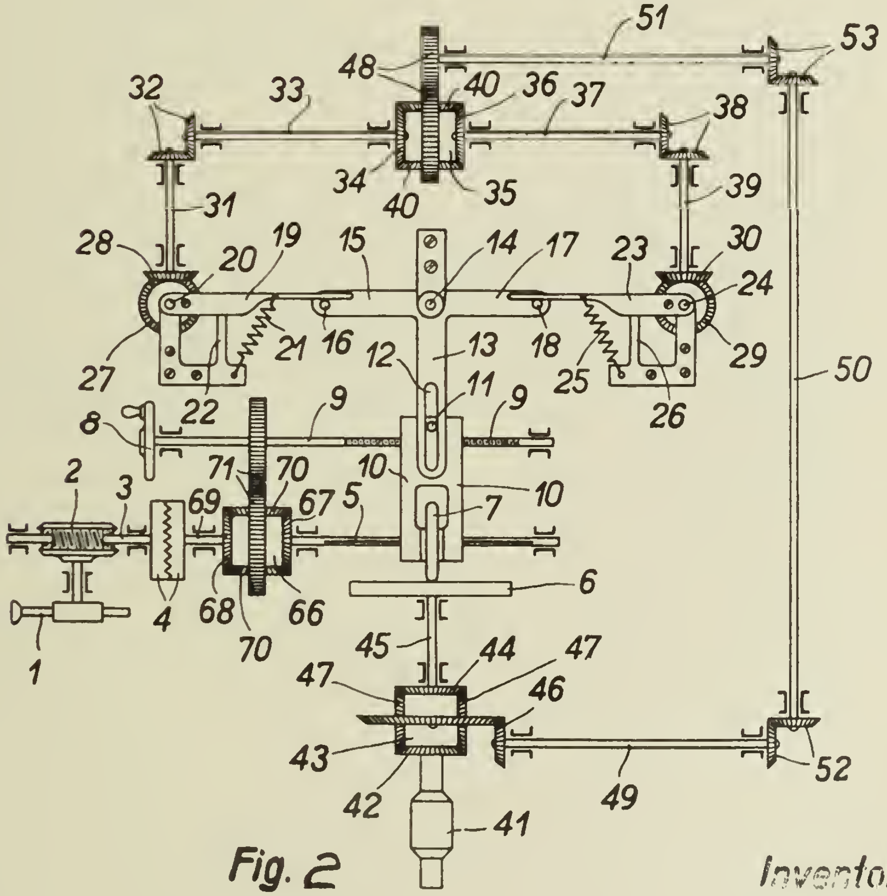


Fig. 2

Inventors:
Karl Papello

PUBLISHED
JUNE 15, 1943.
BY A. P. C.

K. PAPELLO ET AL
DEVICE FOR DIRECTING AND
CALCULATING APPARATUS
Filed Feb. 8, 1940

Serial No.
318,000

6 Sheets-Sheet 4

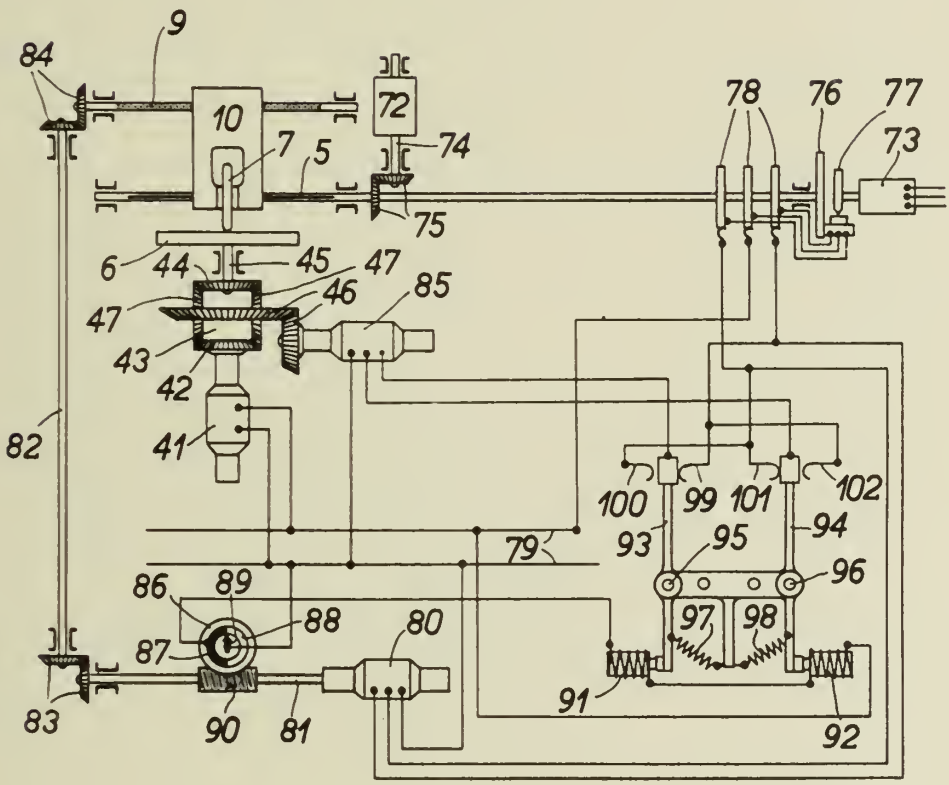


Fig. 3

Inventors:
Karl Papello

PUBLISHED

JUNE 15, 1943.

BY A. P. C.

K. PAPELLO ET AL

DEVICE FOR DIRECTING AND CALCULATING APPARATUS

Filed Feb. 8, 1940

Serial No. 318,000

6 Sheets-Sheet 5

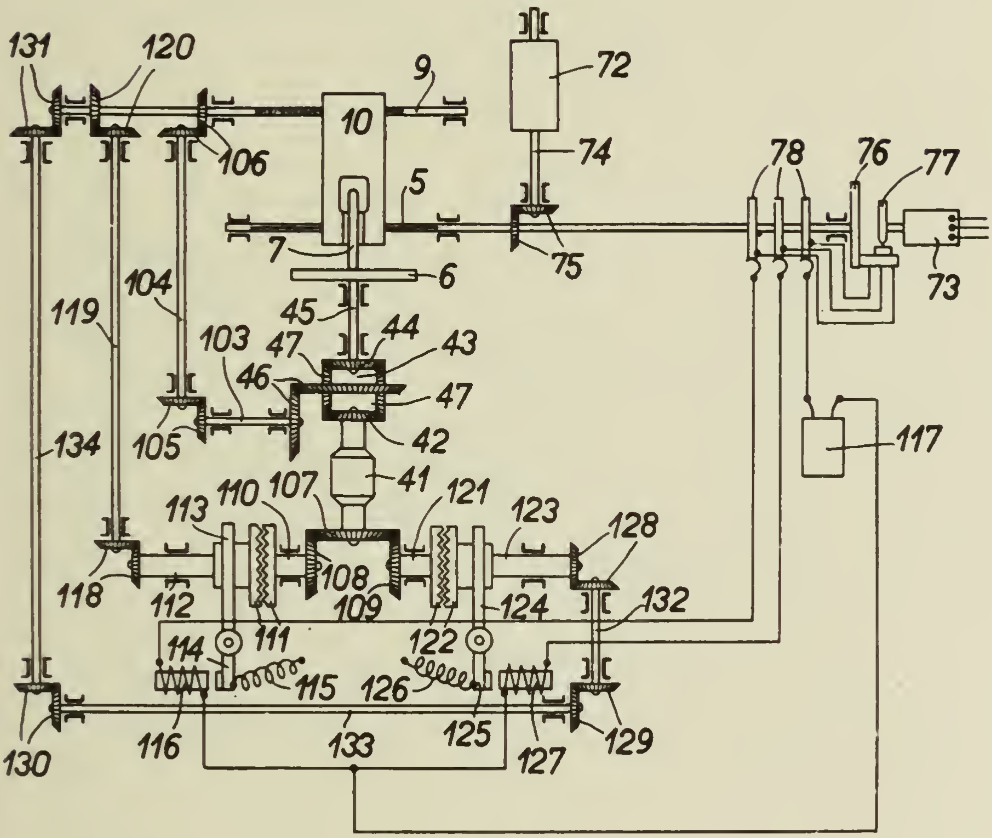


Fig. 4

Inventors:

Karl Papello

PUBLISHED

JUNE 15, 1943.

BY A. P. C.

K. PAPELLO ET AL
DEVICE FOR DIRECTING AND
CALCULATING APPARATUS
Filed Feb. 8, 1940

Serial No.
318,000

6 Sheets-Sheet 6

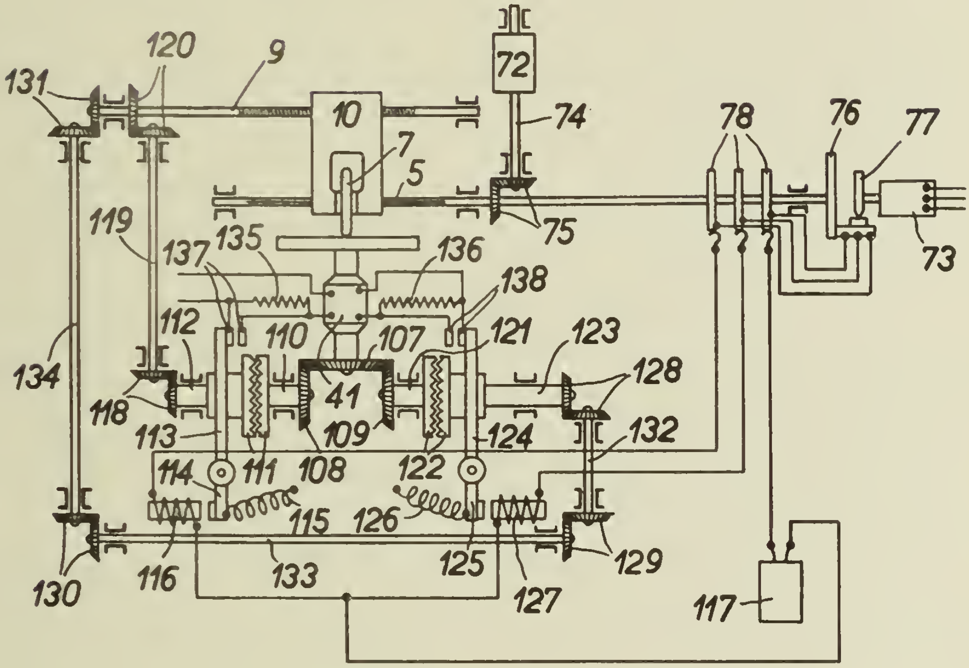


Fig. 7

Inventors:
Karl Papello

Published June 15, 1943

Serial No. 319,098

ALIEN PROPERTY CUSTODIAN

PORTABLE BUILDING STRUCTURES

Andre Faure and Antoine Faure, Firminy (Loire), France; vested in the Alien Property Custodian

Application filed February 15, 1940

The present invention relates to small building structures which are called upon to be frequently erected and dismantled

It has for its object to render these erections and dismantlings very easy and of avoiding the necessity of any but simple elements which when not assembled have a very small bulk which is of particular value for transport.

To this end the invention is characterised by the feature that these building structures are constituted of but a single type of element for both the roof and walls, in the form of a panel extended on one side by a bent portion serving for the attachment both of the walls to the roof and of the two slopes of the roof together, these bent portions fitting one within the other at the ridge, while the opposite extremities of the roof panels form watersheds—or overhanging eaves.

One or more transverse ribs, that is ribs which lie horizontally when the structure is erected, can be provided in the bent portion of each element, the purpose of which is to form as many supplementary interfittings at the ridge, and in the case of pressed sheet metal elements to facilitate the pressing operations.

The elements are preferably of pressed sheet metal but can instead be of moulded material such as fibro-cement; they can be of any suitable section, plane or ribbed, in particular corrugated

By way of modification, the elements can each be made in two parts, one being constituted by a panel whose general form is plane, which can serve equally well for the walls or the roof slopes of the structure, and the other being constituted by a band bent along its middle and serving for the attachment of the said panels to one another, whether the walls to the slopes of the roof or the abutting slopes to one another at the ridge.

The invention will be clearly understood by reference to the accompanying diagrammatic drawings, in which by way of example corrugated panels are shown.

Figure 1 is a side view of one of the elements of the single type used.

Figure 2 is a detail view on a larger scale showing the assembly of the elements.

Figure 3 is a view of the erected structure.

Figures 4 and 5 are side views of the two separate parts constituting an element, namely a corrugated panel and a bent member of plain material, in the case of a modified embodiment of the invention.

Figure 6 is a detail of the assembly of this type of two-part element.

Figure 7 is a view of the assembled structure using this same two-part type of element and

Figure 8 is a detail of the assembly using an alternative form of bent member to that of Figures 4 to 7.

According to one form of the invention to erect the building a number of elements are assembled, all of the one type shown in Figure 1, that is to say each formed of a panel *a* plane or ribbed, of rectangular shape, one margin of which is bent over as at *b*.

Those elements used for the walls of the structure are set with the bend at the top and with their edges *c* on the inside of the building.

Those elements used in the roof are assembled by their bends *b* which are fitted one closely on the other thus forming a reinforced ridge.

The bends of the walls are then secured to the roof panels and the erection thus completed. But the attachment of the walls to the roof might equally be made before the ridge is assembled. The attachment of the elements one to another may be made with bolts and nuts or with pins and cotters.

The bent end *b* of each element may have in addition one or more ribs *d* (two in the example shown in the drawing) which not only facilitates the shaping of the element in the case of pressed sheet metal, but also provides as many supplementary interfittings which facilitates the assembly and reinforces the structure.

It will be apparent that the length of the building only depends on the width of the elements and the member assembled together side by side.

It is also noted that by providing elements of various lengths, by suitably combining them structures of various height and widths can be assembled.

Thus by providing two series of panels of different lengths, four different cross-sectional dimensions of structure can be produced, namely, walls and roof of short elements, walls and roof of long elements, walls of long elements and roof of short elements, and walls of short elements and roof of long elements.

In the modification shown in Figures 4 to 8 the bent part *b* of each element is separate from the panel proper *a*. These bent parts can be plain, i. e. bent from plane material (Figures 4 to 7) or be like the panel *a*, of corrugated section (Figure 8).

When the structure is dismounted these elements can be completely separated or only separated along one edge of the bends so that on the other edge bolt and nut connections could here be substituted for example by rivets. Again plain bent bands as in Figures 4 to 6 could form a prolongation of the panels.

ANDRÉ FAURE.
ANTOINE FAURE.

PUBLISHED
JUNE 15, 1943.
BY A. P. C.

A. FAURE ET AL
PORTABLE BUILDING STRUCTURES
Filed Feb. 15, 1940

Serial No.
319,098
2 Sheets-Sheet 1

Fig. 2

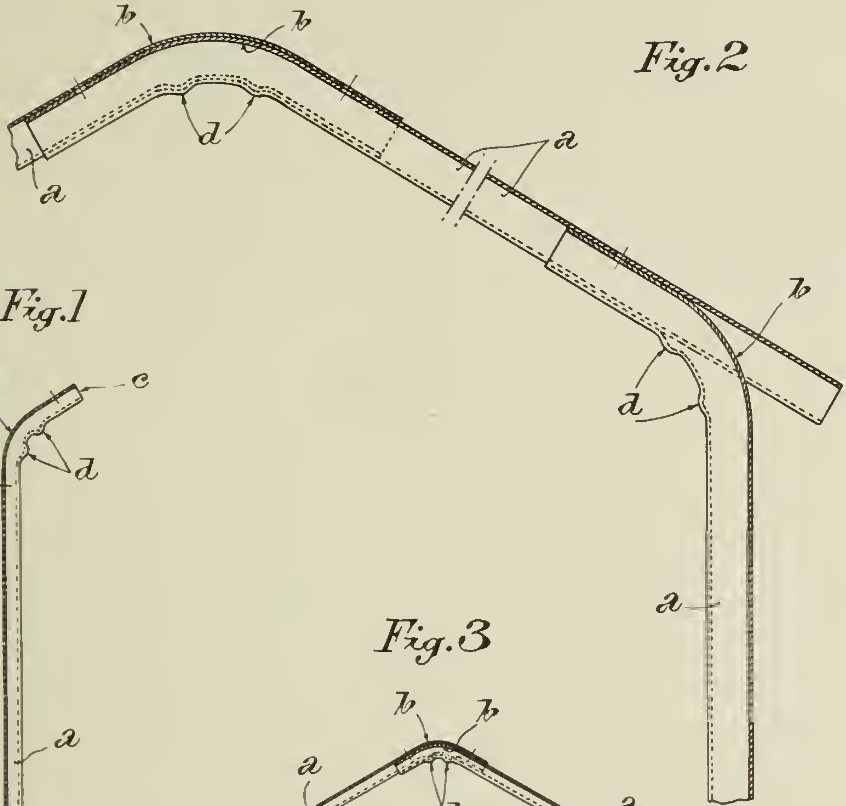
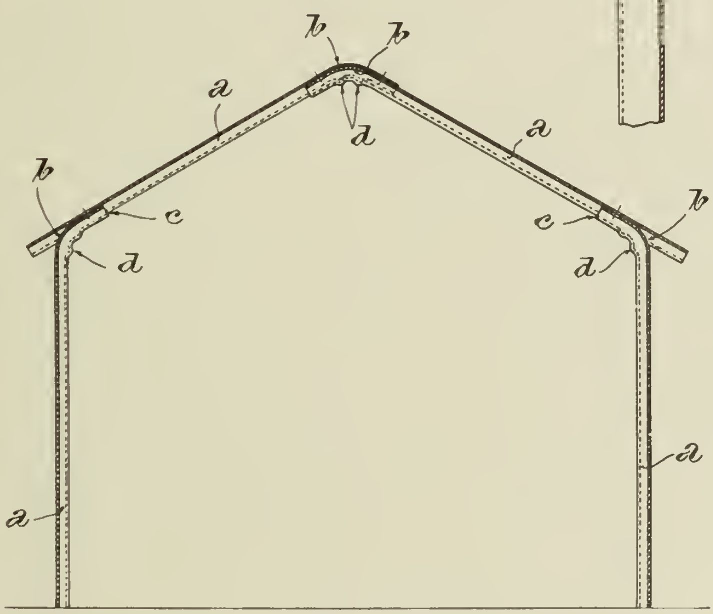


Fig. 1

Fig. 3

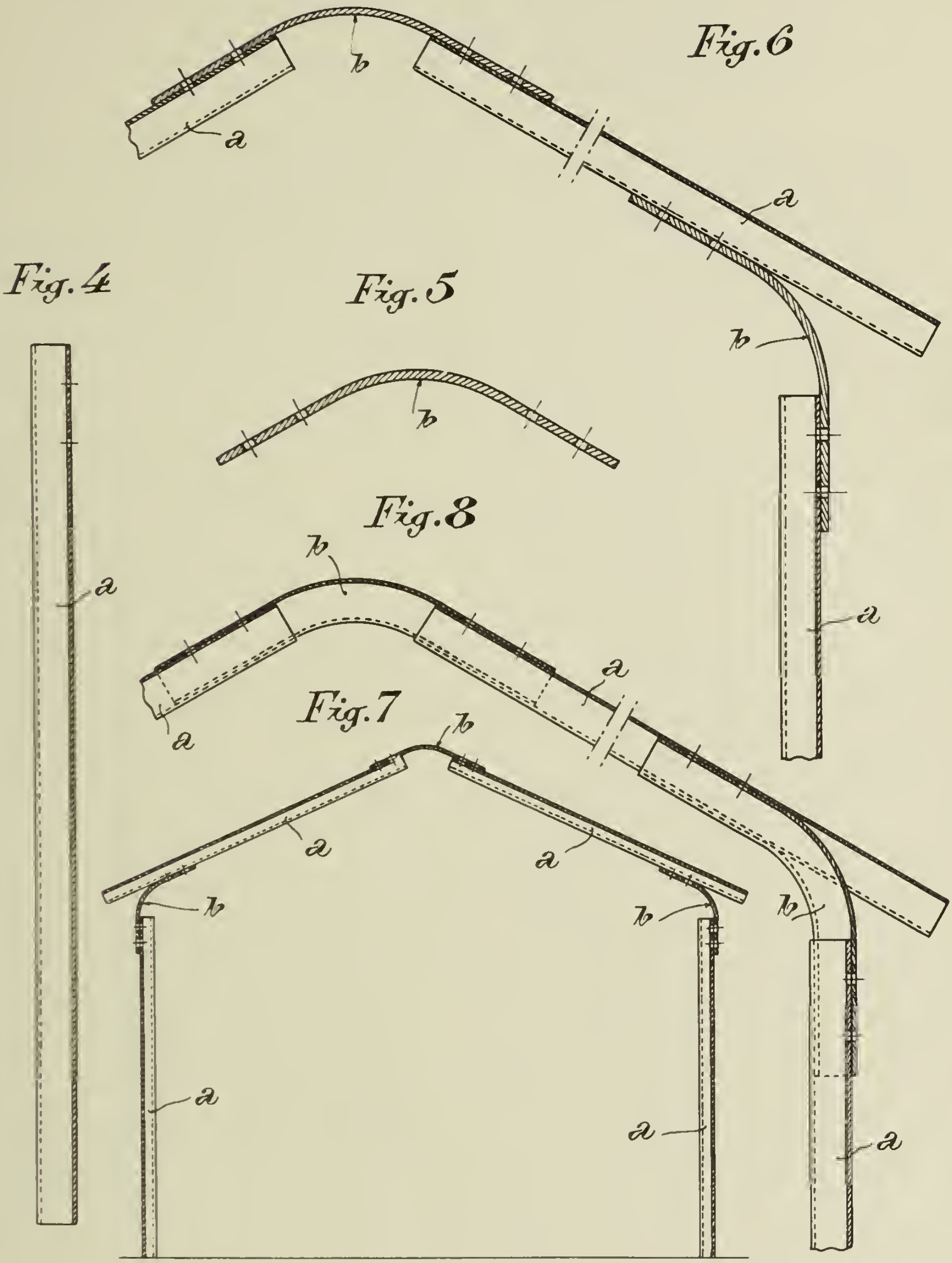


Inventors
André Faure
Antoine Faure
By Otto Munk
their ATTY.

PUBLISHED
JUNE 15, 1943.
BY A. P. C.

A. FAURE ET AL
PORTABLE BUILDING STRUCTURES
Filed Feb. 15, 1940

Serial No.
319,098
2 Sheets-Sheet 2



Inventors
André Faure
Antoine Faure
By Otto Munk
their Att'y

Published June 15, 1943 Serial No. 322,224

ALIEN PROPERTY CUSTODIAN

FILTER-MACHINES FOR COFFEE

Octave A. De Matteis, New York, N. Y.; vested in the Alien Property Custodian

Application filed March 4, 1940

As well known the coffee obtained with the system of steam or boiling water pressure (so-called express coffee) contains a minimum of caffeon oil (roasted coffee) and a maximum of noxious elements. This is owing to the lively and violent pressure of steam or boiling water producing an excessive extracting action on the delicate grain of the coffee. The consequence is a troubled drink of a scarce fragrance and a hard taste.

The coffee is a drink which has conquered the taste of the public not on account of its content of caffein, tannic acid and calcarious residues but only owing to the value of its fragrance constituted by the caffeon oil.

In fact coffee without caffein is drunk with great satisfaction and the unconsciousness of the most clever expert, but coffee is not drunk on account of its antihygienic content of tannic acid, nor coffee would be drunk after subtracting the caffeon oil.

It is consequently justified to think that the great prevalence of this substance on the others which are not wanted in the coffee determines the best quality of the latter and the perfection of the system chosen and used for its preparation.

In the different modifications of the coffee-machine according to the present invention the water does not operate by pressure but only by gravity. By permeating through the layers of coffee, not by a lively, violent, forced action, consequently insufficient to produce the excessive extraction, above mentioned, of noxious substances, the water is only capable of absorbing the only aromatic substances so that a drink is obtained of brilliant colour, conspicuous fragrance and pleasant taste.

In the accompanying drawings the invention is schematically illustrated and utilized with different forms of realisation of machines and exactly:

Fig. 1 is a longitudinal section of a machine whose water discharging tube is disposed within the handle.

Fig. 2 is a similar view with the water discharging tube disposed on one of the sides of the receptacle.

Fig. 3 is a section of another form of realisation in which the water discharging tube is placed in the middle.

Fig. 4 is a section view of another form of realisation comprising a turning tube functioning as a valve.

Figs. 5-6-7 show the details of the fixed and turning tube, the latter seen in the water discharge and distribution of coffee.

Fig. 8 is a plan view of the charging receptacle for powdered coffee with subdivisions to prepare a minimum of coffee in a machine of a larger content, and finally

Fig. 9 is a view in elevation of a tube for discharging water comprising a regulating valve.

With reference to the accompanying figures the coffee machine comprises two main receptacles and accessory parts: reference number 1 indicates the receptacle above the coffee machine; 2 indicates the receptacle containing the powdered coffee charge; 3 is the underlying part functioning as a water boiler; 4 is the tube conveying the boiling water from the receptacle 3 to the receptacle 2; 5 is the cover.

As illustrated in Fig. 3 the tube 4 is solidary to the receptacle 3 and engages a cavity 6 provided in the middle of receptacle 1, the upper end of this tube ending in the interior of a counter tube 7 fixed on the upper filter 8. Said counter tube continues into the interior of receptacle 2 and ends with a head 9 in which there are provided the holes 10 for the exit of the discharging water.

In the Figures 4-5-6 the tube 4 is contained in another tube 11 fixed to the receptacle 1; within this latter there is lodged the tube 12 functioning as a valve and provided with and acted on by a knob 13. The tubes 11 and 12 are provided with corresponding openings 14—15—16 and 14', 15', 16'. These tubes are closed at their bottom. In Figures 4 and 6 there is illustrated the tube 12 in the water discharging position of the receptacle 2 while in Fig. 7 the tube is illustrated turned into the position for the distribution of coffee.

According to the invention the water of the receptacle 3 flows through the tube 4 and ascends by pressure to the receptacle 2 and acts by gravity and not in a boiling state in extracting process of the coffee by permeating the layers of powdered coffee and falling down again under the form of liquid coffee to the bottom of the receptacle 1.

The receptacle 1 may be united to receptacle 3 not only by means of a screwed coupling but also through engagement or any other adapted means. The tube 4 (Fig. 9) may be equally provided with a small valve 17 for regulating the quantity of water to be admitted into receptacle 2 in the case a small quantity of coffee is to be prepared in a machine of a greater capacity and to this object the charging receptacle for the powdered coffee may be subdivided as shown in Fig. 8 or said receptacle may be constructed in convenient proportions to be used in the place of the normal one.

Furthermore the machine may assume different shapes and be constructed of metal, glass, porcelain or of another convenient material whatever.

OCTAVE A. DE MATTEIS.

PUBLISHED
JUNE 15, 1943.
BY A. P. C.

O. A. DE MATTEIS
FILTER-MACHINES FOR COFFEE
Filed March 4, 1940

Serial No.
322,224

Fig. 1

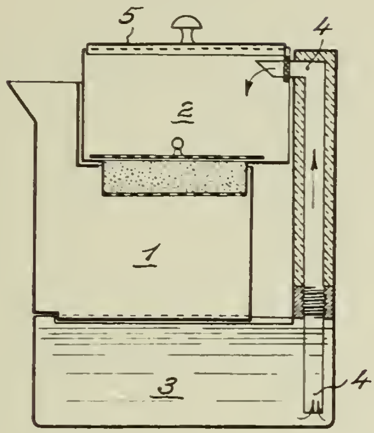


Fig. 2

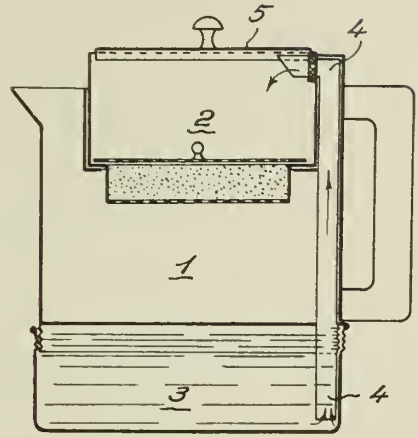


Fig. 3

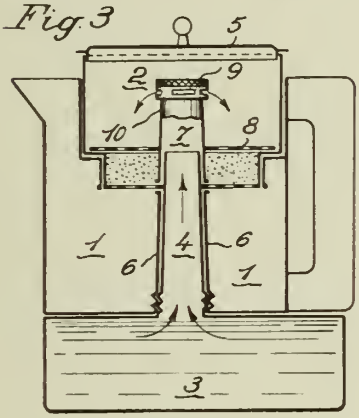


Fig. 4

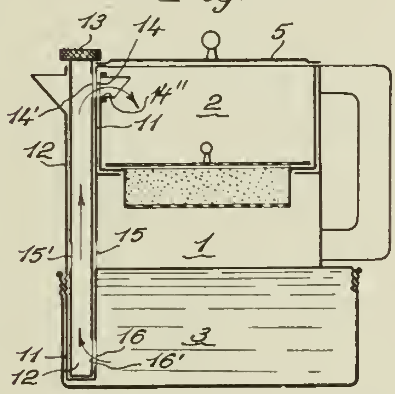


Fig. 5

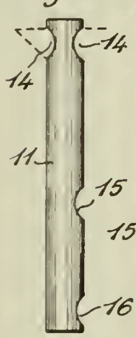


Fig. 6

Fig. 7

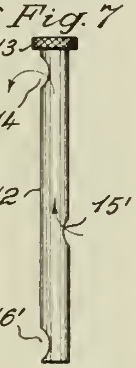


Fig. 8

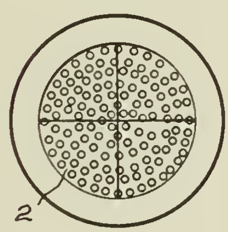
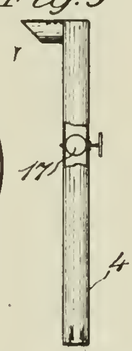


Fig. 9



Inventor,
O. A. De Matteis

By: Glascock Downing & Seebold
Attys

Published June 15, 1943 Serial No. 326,801

ALIEN PROPERTY CUSTODIAN

PROCESS FOR CAUSING LUMINESCENT SUBSTANCES TO ADHERE TO GLASS WALLS

André Claude, Paris, France; vested in the Alien Property Custodian

No Drawing. Application filed March 29, 1940

As it is known, there are two general methods for causing luminescent matters to adhere to glass walls:

The first method consists in first depositing a layer of a binder on the wall, then the luminescent matter on the layer of binder. The binder is subsequently eliminated by heat, so that finally the grains of luminescent matter adhere directly to the glass surface. In particular it has been proposed to employ as binder a solution of boric acid in glycerine. Subjected to purely mechanical action, such as the rubbing of a finger, the luminescent matter thus deposited adheres strongly to the glass surface. On the contrary, subjected to other actions, it adheres but little thereto. For instance, a drop of mercury running on the wall covered with the luminescent matter can detach said matter from the wall. This constitutes a drawback when the surface on which the luminescent matter is deposited is the inner surface of a tube intended to act as electric discharge tube containing mercury.

The second method consists in placing the luminescent matter in suspension in a liquid, in applying the suspension to the glass wall and then eliminating the liquid by heating. For instance, it has already been proposed to make use, as liquid, of nitro-cellulose. In this case, a drop of mercury running on the wall covered with luminescent matter no longer has the effect of detaching said matter. On the contrary, under the effect of a mechanical action, for instance the rubbing of a finger, the luminescent matter detaches more easily than in the case of the first method above mentioned.

The method according to the present invention combines the advantages of the two methods which have just been mentioned, without involving their drawbacks. The method according to the invention is based on the same principle as the second mentioned known method, in which the luminescent matter is deposited on the glass wall in the form of a suspension in a liquid.

According to the present invention, this liquid consists of a mixible mixture, formed on the one hand of a cellulosic ester dissolved in a volatile solvent, and on the other hand of one of the boric, phosphoric, arsenic or antimonic acids, dissolved in the preceding solution, for instance owing to a second volatile solvent.

The above mentioned acids, which have this character in common that they are acid oxygenated compounds of trivalent metalloids, solid at ordinary temperature, can eventually be used simultaneously.

Preferably, the cellulosic ester that is chosen is cellulose acetate and the solvent for the ester is acetone. To the solution of the ester in a volatile solvent there is preferably added a plastifying agent, for instance dibutyl phthalate or benzyl alcohol.

If the acid is soluble in a volatile solvent of the cellulosic ester, the same solvent may be used as solvent for the acid. For instance, if the solution of the cellulosic ester in the volatile solvent consists of a solution of cellulose nitrate in acetone and if the acid consists of phosphoric acid, which is soluble in acetone, acetone can be utilized as common solvent for both the ester and the acid. If, on the contrary, the acid is boric acid, which is little soluble in acetone, it is necessary, before adding it, to dissolve it in a volatile solvent of boric acid, for instance methyl alcohol.

It has been found that the most favorable results, from the point of view of the regularity of the deposit and of the adherence, are obtained by making use of a luminescent matter prepared in extremely fine grains, of the order of magnitude of the micron or less.

Example of a suspension made according to the present invention:

	Grams
Luminescent zinc silicate	60
Acetone	100
Nitro-cellulose	2.5
Anhydrous boric acid	0.18
Methyl alcohol	3.6
Butyl phthalate	Some drops

It will be noted that, in this example, the percentage of boric acid is relatively very low. Experience shows that a very low percentage is extremely efficient for obtaining a strong adhesion. Too large an amount of acid may be disadvantageous for the facility of elimination, subsequently, by means of heat, of the organic compounds present in the liquid.

After having applied onto the glass wall the suspension of the luminescent matter in the liquid mixture, the volatile solvent or solvents is, or are, eliminated through known means, for instance by means of a gaseous stream, such as an air stream, or by heating, or by both simultaneously. Then the whole is heated for decomposing the cellulosic ester and eventually the plastifying body into volatile components which disappear. If the decomposition of the ester produced a carbon deposit, as it is the case with cellulose

acetate, the heating is continued for the necessary amount of time in the presence of air, in such manner as to eliminate carbon by combustion.

Heating may be effected to a temperature sufficient for obtaining the melting of the acid that is utilized. In this case, with boric acid, for instance, an extremely secure fixation of the luminescent matters on the glass wall is obtained.

The method may be well adapted for applying a simple luminescent matter or mixtures of matters, and also for the successive application of several layers of matter.

ANDRÉ CLAUDE.

Published June 15, 1943 Serial No. 326,823

ALIEN PROPERTY CUSTODIAN

GROUND FACING

Jean Bédin, Saint-Cyr-sur-Loire, France; vested in the Alien Property Custodian

Application filed March 29, 1940

The construction of tracks, rolling or supporting surfaces on a ground which is unsuitable for the purpose for which it is intended, or is liable to become so after use, usually requires the use of a facing whereof the weight per square metre covered is comparatively great and whereof the placing in position and the accessory work, for example that of draining the water, take a long time and involve considerable expense. These drawbacks are particularly troublesome in tropical countries, in desert land and in war time, for the construction of aerodromes.

The present invention enables these drawbacks to be avoided and consists in incorporating in the ground, preferably on a vegetable layer which exists or has to be created, a facing whereof the elements include one or a plurality of the following pecularities:

(*a*) The lower face of the element is in the shape of one or a plurality of arches, the convexity of which is turned upwards.

(*b*) The arch is connected to the upper face of the element through one or a plurality of holes.

(*c*) The element is shaped like a polygonal prism (for example a prism of which the base is an equilateral triangle).

(*d*) The angles of the prism are truncated, for example rounded.

(*e*) The lower face of the element is provided, preferably in the immediate vicinity of the angles it forms, with courses on which it is more particularly adapted to bear on the ground and which form the pillars of the arch formed by the lower face of the element.

(*f*) The lateral sides of each element are provided with projections and slots which are arranged in such a manner that the projections of one element fit into the slots of the adjacent element and conversely.

(*g*) The upper face of the element is provided with grooves, for example in the shape of portions of a circle, having as their centre the apex of the angles it forms.

The present invention also covers any facing whereof at least a part is formed by elements such as those described above.

In particular, said facing is formed by the juxtaposition of elements such as those described above, which are secured to each other by metallic or non-metallic rings placed in the circular grooves referred to above.

By way of example, a facing element according to the present invention has been shown in the accompanying drawing.

Figure 1 is a top view of said element.

Figure 2 is a bottom view of said element.

Figure 3 is a view of one side of said element.

Figures 4, 5 and 6 are respectively sections along the lines IV—IV, V—V and VI—VI of Figure 1.

The element shown is generally shaped like a prism, the base of which is formed by an equilateral triangle whose angles are rounded. Its lower face 1, resting on the ground to be faced, is shaped like an arch 2, the convexity of which is turned upwardly. The element rests first of all on the ground by means of the three pillars 3 of the arch 2 which are placed as close as possible to the apices of the triangle. The loads supported by the upper face are thus transmitted to the ground by the pillars 3 without overhang. Maximum stability and strength are thus obtained. The element also rests on the ground by the reaction of the latter on the arch 2. The earth, in fact, comes into the space formed by the arch 2 and the latter, by bearing on the earth, contributes to support the element.

In order to enable the element to rest resiliently on the ground, the arch 2 is connected to the upper face 11 thruogh a hole 4, the cross-section of which is of smaller size than that of the arch 2. A resilient cushion is thus obtained and the facing therefore retains a flexibility which is advantageous and necessary in the case of the landing of aeroplanes, for example.

The elements are secured to the adjacent elements:

(*a*) In the first place by means of male jointings 21 and female jointings 22 on the sides. Said jointings 21 and 22 are such as to ensure the most perfect interchangeability.

(*b*) Then, optionally by means of metallic or non-metallic rings arranged in circular grooves 12 which are provided in the face 11 and the centres of which coincide with the apices of the triangle forming the base.

By means of these methods of connection, the loads received by an element are transmitted to the elements involved through the projections 21 and the slots 22 and the rings. There is consequently no danger of the covered surface being deformed.

It should be observed that, owing to the rounded shape of the apices, there is formed between the six elements which face each other by their apices in pairs a hole shaped like a star with six arms which, together with the holes 4, contribute to the resilient support of the elements by the ground and allow the rain water to penetrate into

the ground and enable favorable conditions for the development of vegetation to be maintained or created, thereby enabling a strong, flexible, permeable rolling surface to be obtained which acts as a protecting screen for the land proper.

The mounting of said elements is of the simplest nature. It is sufficient, before placing the elements in position, to effect if necessary a levelling of the ground and the removal of the hard bodies, large stones for example. In every direction, the pattern is regular; radii of any size are permissible; disfiguring is impossible in any direction of circulation. If, for any reason, an element has to be removed in the middle of the covered surface, it is possible to replace it without removing a plurality of elements.

Of course, the present invention is not limited to the elements described above; thus for example said elements could be made of stamped sheet metal or of any metal or material. Similarly, their dimensions and shapes could be modified according to the purpose for which they are intended. It would thus be possible to provide longitudinal reinforcements extending over several elements in order to reinforce the facing.

JEAN BÉDIN.

PUBLISHED

JUNE 15, 1943.

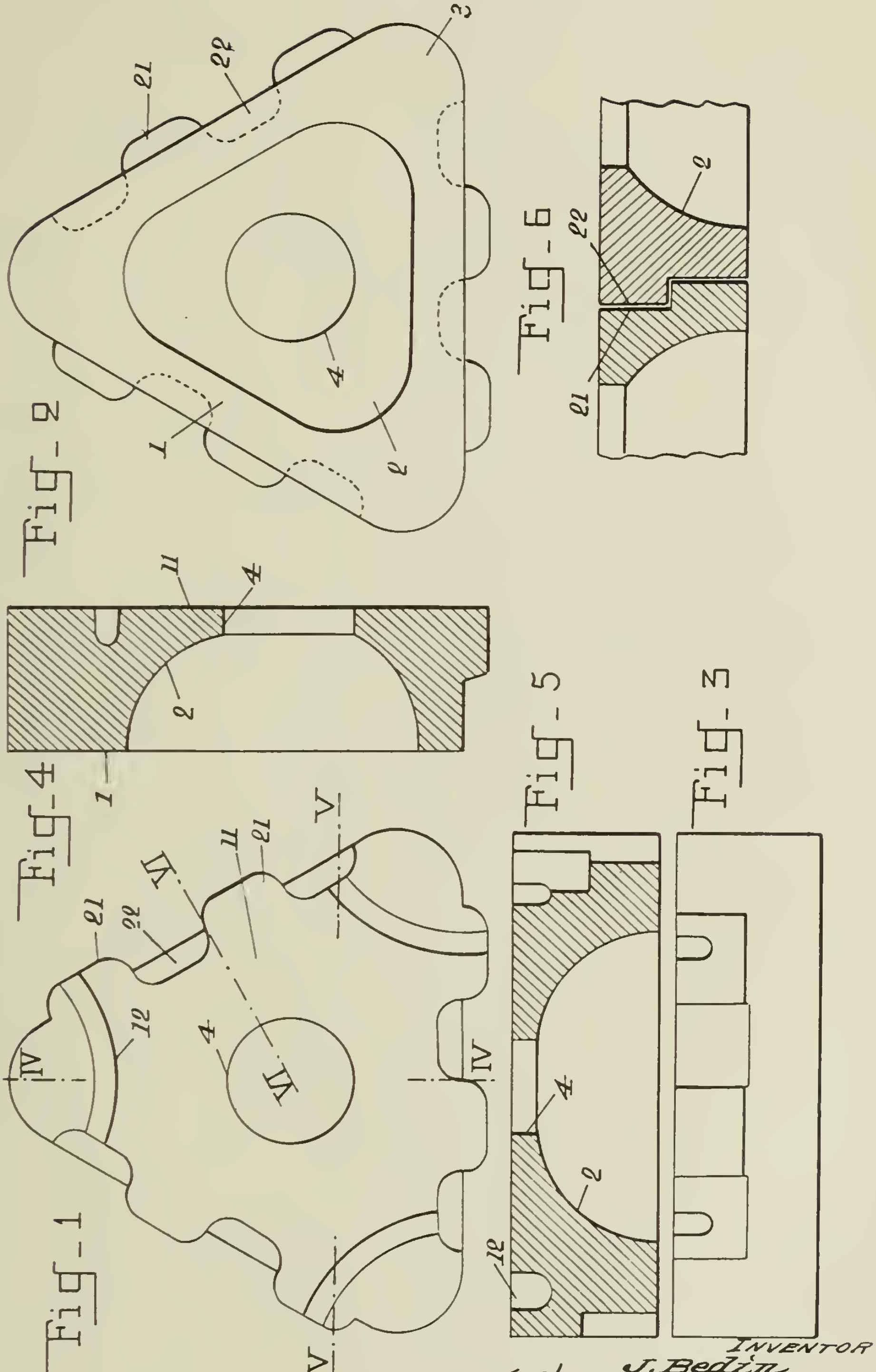
BY A. P. C.

J. BÉDIN

GROUND FACING

Filed March 29, 1940

Serial No. 326,823



INVENTOR
J. Bedin

BY E. F. Wendiroth

ATTORNEY

Published June 15, 1943

Serial No. 333,847

ALIEN PROPERTY CUSTODIAN

SHOCK ABSORBERS

Georges Henri Ernest de Ram, Boulogne-sur-Seine, France; vested in the Alien Property Custodian

Application filed May 7, 1940

The invention concerns improvements in shock absorbers or dampers applicable to various purposes but especially to vehicle suspension systems.

The shock absober according to the invention consists essentially of two relatively movable parts in the form of a casing and a member movable within the said casing, the space between them being adapted to contain a liquid, and the movable member has a channel or bore within which works a piston, the movements of which in the said channel are guided by means of a cam provided in the casing, and orifices or valves are provided for allowing access and escape of liquid to and from the said channel according to the movements of the piston.

Usually the member movable within the casing will be the shock receiving member, being connected for example to a vehicle axle, whilst the casing will be fixed to the chassis.

More particularly described, an example of the shock absorber according to the invention comprises a casing of substantially cylindrical shape which is adapted to be fixed to the chassis and is closed at both ends. Inside this casing is arranged a floating disc or drum which is adapted to turn freely and which is preferably guided at each side by a ring. The said disc is adapted to be connected to the vehicle axle by means of a lever. At the median plane of the disc is provided a bore adapted to accommodate a piston subjected on the one hand to the action of a spring and on the other to a roller which is in contact with a fixed cam. The bore provided in the disc is arranged to communicate with the inside of the casing by means of a conduit which is provided with a clack valve or ball valve. An escape orifice appropriately calibrated provides direct communication between the bore and the inside of the casing.

If the casing of the shock absorber is filled with an appropriate liquid, the displacements of the axle, and consequently those of the lever fixed thereto, will be transformed into alternations of pressure and depression set up in the bore provided in the median plane of the disc, and will have the effect of applying the disc against its casing in a manner somewhat similar to that in which a braking segment moves inside its drum.

In order that the invention may be completely comprehended an example will be described in detail with reference to the accompanying drawing in which:

Fig. 1 is a longitudinal section through the shock absorber.

Fig. 2 is a transverse section.

The shock absorber comprises a casing 1 of cylindrical form fixed, for example, to the chassis, and inside which is freely movable a disc 3 guided by means of two crowns or rings 2. At the end of the said disc is fixed a lever 4 by means of a bolt 5, to which are transmitted by any suitable means the movements of the vehicle axle. The disc 3 is provided at its median plane with a vertical bore which communicates at its lower end with the interior of the casing 1 by means of a channel 8. In the said bore 7 is mounted a piston 9 subjected to the action of a spring 10, which spring is itself supported at the lower end upon a cup 11 resting on the bottom of the bore 7. This cup 11 is provided with an orifice 11[1], and houses a spring 12 acting on a ball or clack valve 13 which obturated the channel 8 making communication between the bore 7 and the interior of the casing 1.

A roller 14 is freely mounted at the head of the piston 9 and by means of the spring 10 is pressed against a cam member 15 which is held in place by a screw 16. A suitable orifice 17 which is preferably variable allows direct communication between the bore 7 and the interior of the casing 1.

The disc 3 and the rings 2 are maintained in place inside the casing 1 by a threaded ring 19 which clamps an elastic disc 20 co-operating with a packing piece 21 for ensuring the tightness of the apparatus.

If the casing 1 is filled with a suitable liquid, it will be understood that the oscillations or displacements received by the lever 4 will be communicated to the disc 3 which will then itself oscillate inside the casing 1. These oscillations which take place on one side or the other of the theoretical axis of the apparatus and which have a greater or less amplitude, will have the effect, in consequence of the inclination in one sense or the other of the bore 7, of effecting contact of the roller 14 under the action of the spring 10 with the one or the other part of the cam 15. The expansion of the spring 10 causes displacement of the piston 9 at the same time creating a fall of pressure at its lower end. This is such that the ball 13 is lifted and allows liquid inside the casing 1 to penetrate the bore 7 beneath the said piston 9, and this in a greater or less quantity corresponding to the displacements.

On the displacement of the piston in the reverse direction the liquid which has been drawn in is forced back through the calibrated orifice 17.

The pressure which is built up beneath the piston 9 has the effect of forcing the periphery of the disc 3 against the casing 1 in a similar manner to a segment against a braking drum.

An example has been described wherein the disc is connected to a vehicle axle, but the invention is obviously not limited in this respect nor to any particular way of connecting the disc or the casing to other parts. It is sufficient for the invention if the disc is capable of being connected to a shock receiving part such as a vehicle axle.

GEORGES HENRI ERNEST DE RAM.

[illegible]

PUBLISHED

JUNE 15, 1943.

BY A. P. C.

G. H. E. DE RAM

SHOCK ABSORBERS

Filed May 7, 1940

Serial No.
333,847

Fig_1

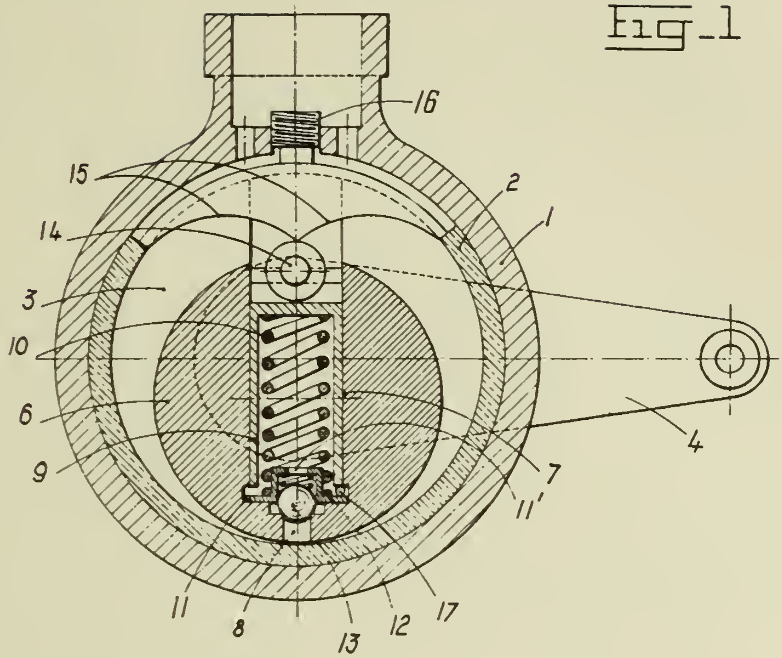
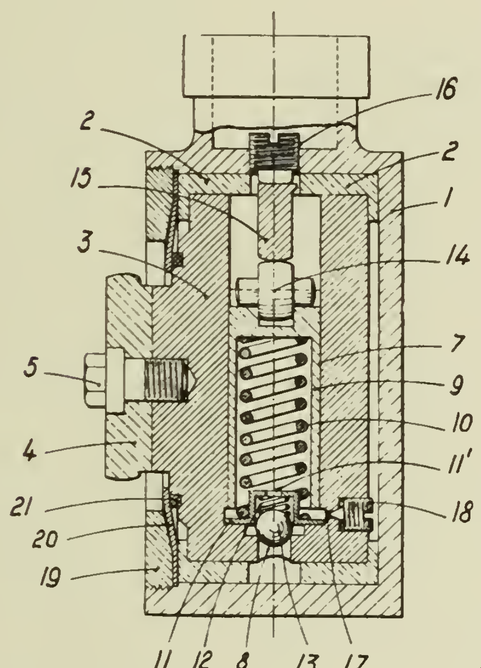


Fig_2



Inventor,
G. H. E. de Ram

By: Glascock Downing & Seebold
Attys.

Published June 15, 1943

Serial No. 339,411

ALIEN PROPERTY CUSTODIAN

GRADUAL SPEED CHANGING DEVICE

Umberto Finzi, Toulouse, France; vested in the Alien Property Custodian

Application filed June 8, 1940

This invention relates to a power transmission device capable of connecting a driving shaft to a driven shaft with a variable speed ratio.

An object of my invention is to provide a power transmission device comprising only constant mesh gearings, the speed ratio whereof may assume any value within a certain range; and wherein the passage from any value of the speed ratio to any other takes place gradually without any discontinuity or steps.

Another object of my invention is to provide a device of the kind described which operates automatically within a certain range, so that whenever the ratio of the resisting torque to the driving torque varies the speed ratio automatically changes and an optimum value thereof corresponding to the new torque ratio is immediately attained; and the operation whereof, however, can be concurrently controlled and modified at will by an operator.

Other objects and advantages of my invention will become apparent as the description proceeds.

According to the general principle of my invention, the driving power is decomposed in two parts by means of epicyclic gear trains with two degrees of kinematic freedom; these two separate parts of the driving power are then conveyed onto the driven shaft by means of other epicyclic gear trains; and between two or more conveniently connected epicyclic gear trains there is arranged a device comprising two members which revolve at different speeds, said device permitting to control at will and gradually the speed ratio of the transmission.

For this purpose I may employ purely mechanical means, such as a friction clutch wherein a certain amount of slippage is permitted; or electro-mechanical means, such as an electric motor having a revolving armature and a revolving inductor. I will use thereafter the generic expression "slip device" to denote any device of such kind.

In order that the spirit of my invention may be better understood, the following description will comprise a brief theoretical discussion of the interrelationship of the speeds of the three members of a generic epicyclic gearing.

In the drawings:

Figs. 1 to 5 are generic speed diagrams of epicyclic trains, to be used in the aforesaid theoretical discussion. The speeds are denoted by the letter n.

Fig. 6 is a longitudinal section of a mechanical embodiment of my invention and Fig. 7 is the speed diagram relating thereto, wherein the speeds are denoted by the letter V.

Figs. 8 and 10 are longitudinal sections of electro-mechanical embodiments of my invention and Figs. 9 and 11 respectively are the speed diagrams relating thereto. The speeds are denoted by the letter w in Fig. 9 and by the letter v in Fig. 11.

The velocities of the three members of an epicyclic train may be plotted in a system of rectangular axes in such a way that they will be represented by three straight lines having one point in common. In the appended diagrams all the speeds are plotted versus the ratio of two of them taken as abscissa, so that:

$$x=\frac{n_2}{n_1}$$

In Fig. 1, n_1 remains constant, n_2 varies from 0 to 1 (the latter being the point common to all of the three lines); then n_3 will be represented by a straight line passing through the point where the first two lines meet. The work furnished to the first member of the train is transmitted to the other two members proportionally to the speeds thereof.

Fig. 2 shows how the work L_1 furnished to the member having the speed n_1 is apportioned among the two members having the speeds n_2 and n_3. The sum of the three works is always zero, that is the equation: $L_1+L_2+L_3=0$ always holds; and L_1, L_2, L_3 may be the work of three motors having respectively the speeds n_1, n_2, n_3.

If by means of an ordinary gearing the speed n_1 is reduced to n_1' (see Fig. 3), speed of a member of another epicyclic gear train, and if the speed of the second member of this other train is: $n_2'=n_2$, the speed of the third member will be represented by the line n_3' passing through the point where n_1' and n_2' meet.

Inversely, n_3 and n_3' may represent the speeds of a variable speed source of power, which may be connected through a third epicyclic gear train to the driving or the driven shaft, by means of an ordinary or an electromechanical transmission. These two cases have been represented in Figs. 4 and 5.

In Fig. 4 the composition of the speeds n_3 and n_3' is accomplished by a third train one of the members whereof has the speed n_1'' proportional to the speed n_1 of the motor. In Fig. 5 one of the members of the third train, instead of having the speed n_3, has a speed n_3'' represented by a parallel to n_3, so that it is: $n_3''-n_3=$constant.

We may suppose that n_3 and n_3'' represent

the absolute speeds of two members capable of having a slip with respect to one another, such as for instance the armature and the inductor of a motor; then a certian amount of power will be transmitted from n_3'' to n_3, if the motor is fed by means of the current furnished by a constant speed generator.

By way of example, Fig. 6 shows a variable speed transmission constructed according to my invention and comprising three epicyclic gear trains. Referring to Fig. 6, the numeral **1** denotes the driving shaft to which is fastened the bevel gear **2** of the first epicyclic train. The velocity of said shaft and bevel gear is represented by V_1 and is supposed to be constant (and equal to 1) in the diagram of Fig. 7. This supposition should never be construed as a limitation, as all the embodiments of my invention can be applied equally well to variable speed motors, such as internal combustion engines. In this case, to every value of the speed of the driving shaft there correspond an infinity of values of the speed of the driven shaft; and the variations of the driving velocity are superimposed on the variations of the transmission's speed ratio.

The frame **3** of the first gear train is fastened to the driven shaft, the speed whereof is represented by V_2 which varies together with

$$x=\frac{V_2}{V_1}$$

Said frame **3** carries the planetary gears **5** at the same speed V_2.

These planetary gears mesh with the pinions **6** and **7** which turn loosely on the driven shaft **4** and carry the gear **6'** and the sprocket **15** fastened thereto. The frame **3** also encloses the bevel gear **19** which runs freely on the shaft **1** and is keyed to the shaft **18**. On the same shaft **1** turns loosely the pinion **22** which is fastened to the bell **23** of a conical friction clutch; the cone **24** of said clutch is keyed to the shaft **1** by means of a slidable key; thus by operating the lever **25** the cone clutch can be thrown in and out of engagement and the slip between **23** and **24** may be controlled.

The pinion **22**, driven by the bell **23**, transmits the power to the frame **8** of another epicyclic gear train through the gear **21**, fastened to the frame and shaft **8**. The frame **8**, by means of the planetary gears **9**, carries the bevel gears **10** and **11** in revolution; and these latter, in turn, are fastened to the sprockets **13** and **16**, the speed whereof is represented in the diagrams of Fig. 7 by the straight lines V_2 and V_3.

As the bevel gear **19** and the sprocket **18** fastened to each other also revolve at the speed V_3, they may be coupled through the chain **17** with the bevel gear **11** and the sprocket **16**, with a speed ratio of 1/1. Similarly, as the pinion **7** and the sprocket **15** fastened to each other revolve at the speed V_2', they may be connected through the hollow shaft **12** and the chain **14** to the bevel gear **10**, with a speed ratio of 1/1. In turn, as the frame **8** revolves at the speed V_1'' and the rigidly coupled gears **6** and **6'** revolve at the speed V_1', and since the speeds V_1' and V_1'' are equal in magnitude and opposite in direction, said case **8** may be connected to said gears **6**, **6'** through the gear coupling **6'—8'**, the gear **8'** being fastened to the frame **8**.

The device operates as follows: When the motor runs and the driven shaft does not turn, there is a slippage between the two members of the cone clutch **23—24**. This slip is represented in Fig. 7 by V_1 minus $(-V_1''.5)$, because in the described assemblage the gear ratio of the coupling **21—22** is ⅕; the gear ratios have been chosen in such a way that V_1'' is not parallel to the axis of the abscissae, but very slightly divergent.

As the cone **24** is pressed against the bell **23**, the driving shaft transmits to the frame **8** a part of the driving power, while the rest of the power is transmitted directly through the bevel gear **2** to the frame **3**, that is to the driven shaft which is fastened thereto.

As the pressure of **24** on **23** is increased, a greater portion of the motor's power is transmitted through the secondary shaft **8**, which, by means of the transmission arrangements **8'—6'**, **13—14—15**, and **16—17—18**, transmits the power received to the driven shaft through the epicyclic gears located in the frame **3**, with a low speed ratio.

If the pressure between **23** and **24** is increased, the slip between these two elements decreases and consequently the driven shaft accelerates until a state of equilibrium is reached between the external resisting torque applied to the driven shaft, the driving torque, and the torque transmitted through the friction clutch due to the pressure of **24** on **23**.

If the resisting torque, for any reason whatsoever, tends to increase, and if the pressure of **24** on **23** remains constant, the slip between **23** and **24** increases and the speed of the driven shaft diminishes until a new state of equilibrium is attained; and this action is substantially automatic for wide enough variations, as the slip of the friction clutch is proportional with a sufficient approximation to the pressure exerted by the members **23** and **24** on each other.

In conclusion, the friction clutch operates as an apportioner of the power among the direct transmission through the shaft **1** and the bevel gear **2** and the reduced speed transmission **8**, overloading this latter when the resisting torque of the driven shaft increases. A manual non-automatic control of the transmission is afforded by the lever **25**, and this manual control may be superimposed on and coact with the automatic speed control previously described.

An electro-mechanical transmission constructed along the lines of the diagram of Fig. 5, will operate in an analogous manner. If between n_3 and n_3'' (Fig. 5) there is inserted an asynchronous rotating field motor with inductor and armature both revolving, and if the inductor is fed with the current generated by a constant speed alternator, a torque is transmitted between n_3 and n_3'' which conveys the power to the members n_1''—n_3'—n_3'', to the driven shaft and to the driving shaft. If the relative speed n_3—n_3'' is not exactly constant, but variable from 0 to 10%, the torque transmitted from inductor to armature increases automatically as the resistance on the driven shaft increases. The driven shaft has a tendency to slow down while the driving shaft maintains its constant speed. However, during the period of the starting of the driven shaft, it would suffice to control the excitation of the alternator which feeds the asynchronous motor inserted between n_3 and n_3'', whereby the torque transmitted from inductor to armature is also controlled.

Fig. 8 shows one such electro-mechanical embodiment of my invention. Therein, the driving shaft, which is denoted by the numeral **26**, revolves at the speed w_1 which is constant and has been made equal to **1** in the diagram of Fig. 9.

The driven shaft 27 has the variable speed w_2. An auxiliary shaft 28 turns at the speed w_1' which is a fraction of w_1.

To the driving shaft 26 are fastened the gear 29 and the supporting member or frame 30 which carries the pinions 31; and on the same shaft 26 is also keyed the armature 32 of an alternator, the stator whereof is denoted by the numeral 33; therefore the members 29, 31, 32 all turn at the speed w_1. The planetary pinions 31 mesh with the pinions 34 and 35. The armature 37 of an electric motor is keyed to the shaft 27 and therefore revolves at the speed w_2.

The gear 34 and the sprocket 36, rigidly connected to each other, run freely on the shaft 27 at the speed w_3. The shaft 27 also carries at the speed w_2 the armature 37 of an asynchronous motor.

The inductor 38 of said motor turns loosely on the shaft 27 at the speed w_2'. The gears 39 and 40 are fastened to the shaft 28 and revolve therefore at the speed w_1' which is maintained in a constant ratio to the speed w_1 of the shaft 26 by the gear coupling 29—39. The pinion 40 meshes with the planetary pinion 41 which is pivoted to the frame 42. This latter is fastened to the sprocket 43 and turns loosely on the shaft 44 together with said sprocket.

The shaft 44 revolves with the speed w_2'' and has the gears 45 and 46, which revolve therefore at the same speed w_2''. The gear ratios of the connection 40—46—41 have been chosen in such a way as to give to the frame 42 and the sprocket 43 the same speed w_3 of the gear 34. The gear 45 meshes with the gear 47 which is rigidly connected to the inductor 38, and the sprockets 36 and 43 are coupled by means of a chain. The speed ratios are such that 47 revolves at the speed w_2' while 36 revolves at the speed w_3.

The device operates as follows.

The driving shaft 26 revolves at the constant speed w_1 and it carries the armature 32. If there is no exciting current in the stator 33, no torque is transmitted to the driven shaft 27.

As the stator 33 is supplied with an exciting current, the armature 32 furnishes an electric current which is conveyed through a suitable line to the inductor 38: then a torque is transmitted from 37 to 38. These two members however have different speeds, as 37 turns at the speed w_2 and 38 at the speed w_2'. This means that in the inductor 38 there is created a rotating or Ferraris field, the absolute speed whereof is represented by w_2; and that, because of this rotating field, the armature 37 fastened to the shaft 27 revolves under the action of a torque which will become stronger with any increase of the exciting current in the stator 33.

While the shaft 26 carries the armature 32, it also carries the planetary pinions 31 which mesh with 34 and 35 and transmit the driving torque to the driven shaft 27 and therefrom, through the members 36 and 43, to the shaft 42. Meanwhile, the driving shaft 26 through the gear coupling 29—39 drives the shaft 28 into revolution at the constant speed w_1'.

As a consequence of the arrangement adopted, the work transmitted to the shaft 28 is divided by the gear train 40—42—46 into two portions, whereof one is transmitted to the shaft 44 and therefrom through a direct coupling to the inductor 38, and the other to the sprocket 43 and therefrom through a direct coupling to the sprocket 36.

The speed of the various members of the device will be such as is required to bring about the equilibrium of all the external torques applied thereto, that is: the resisting torque on the shaft 27; the driving torque on the shaft 26; and the braking torque between 32 and 33 due to the excitation of the alternator.

If this last torque and the driving torque remain constant, the speed of the shaft 27 will assume the value whereby the work of the resisting torque becomes equal to that of the driving torque, except for the amount of work lost in the transmission.

My transmission can also be fed from an external line; in this case the alternator 32—33 will operate as a synchronous motor, or will be replaced with an asynchronous motor of suitable power. An embodiment of this type is illustrated in Figs. 10 and 11.

The prime motor 48, fed from the main electric line, drives the shaft 49 and the sun gear 50 at the constant speed v_1. The driven shaft 52 with the planetary pinions 51 revolves at the variable speed v_2. The sun gear 53, the hollow shaft 54, and the armature 55 of the secondary motor, also fed from the main line, revolve at the speed v_3. The inductor 56 of the secondary motor, the hollow shaft 59, and the sprocket 57 revolve at the speed v_3' differing from v_3 by a constant amount.

The same speed v_3' is transmitted in the ratio 1/1 from the sprocket 57 through the chain 62, the sprocket 58, and the hollow shaft 63, to the frame 64 of a second epicyclic gear train. The sun pinion 65 of said second train is fastened to the shaft 67 and is connected with a speed ratio of $-1/1$ to the driven shaft 52 through the gearing 60—61: it turns therefore at the speed $v_2' = -v_2$. The other sun pinion 66 of the same train is fastened to the shaft 68 connected to the driving shaft through the gear coupling 69—70: it revolves therefore at a constant speed v_1' proportional to the speed v_1 of said driving shaft. The operation of the device is similar to that previously described.

In this last and in analogous forms, my device can operate as the "controller" of electric traction vehicles, such as trolley cars, electric locomotives, and even electric automobiles; and can generally be useful in all the cases wherein a variable speed and an easy start are desired, whether the motor be an electric or a mechanical one.

The many advantages and possible applications of my invention will now be apparent to the persons skilled in the art to which is appertains.

UMBERTO FINZI.

PUBLISHED
JUNE 15, 1943.
BY A. P. C.

U. FINZI
GRADUAL SPEED CHANGING DEVICE
Filed June 8, 1940

Serial No.
339,411
4 Sheets-Sheet 1

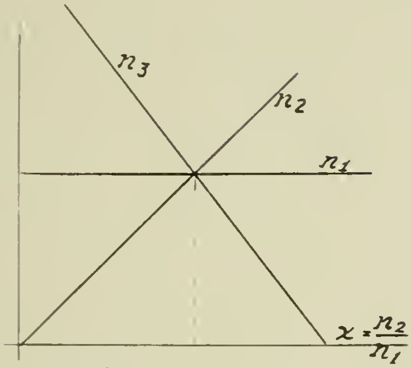


FIG. 1

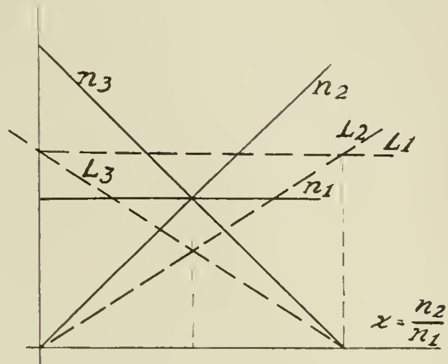


FIG. 2

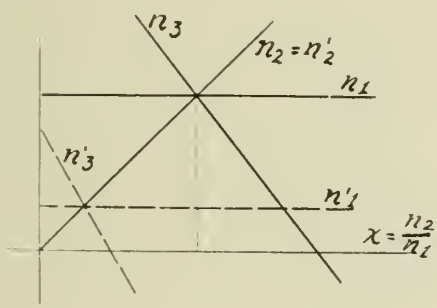


FIG. 3

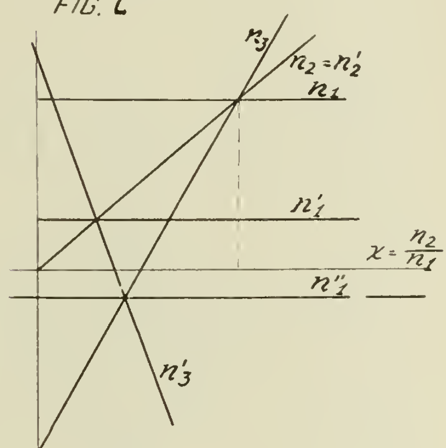


FIG. 4

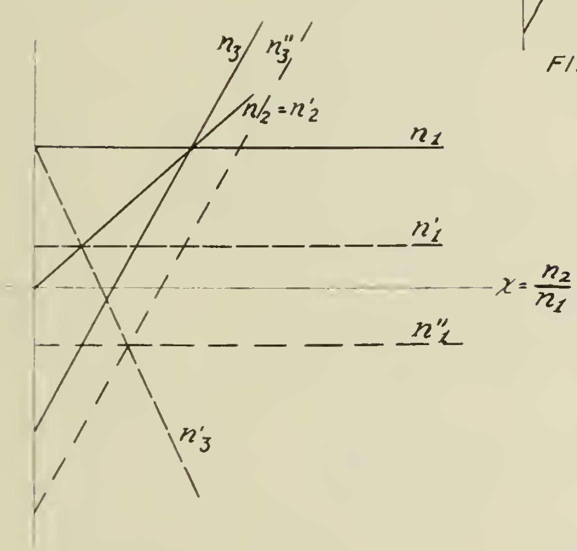


FIG. 5

UMBERTO FINZI INVENTOR.
BY
Edgar Luzzatto
AGENT

PUBLISHED	U. FINZI	**Serial No.**
JUNE 15, 1943.	GRADUAL SPEED CHANGING DEVICE	**339,411**
BY A. P. C.	Filed June 8, 1940	4 Sheets-Sheet 2

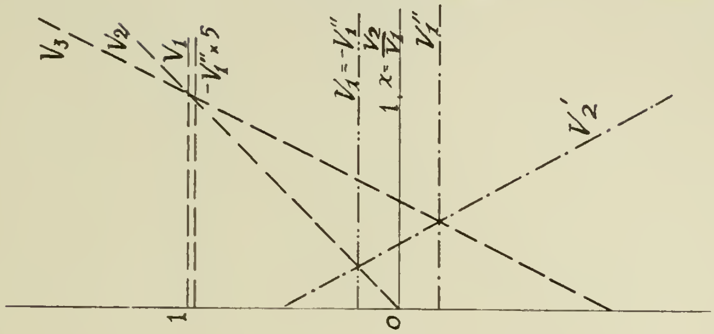


FIG. 7

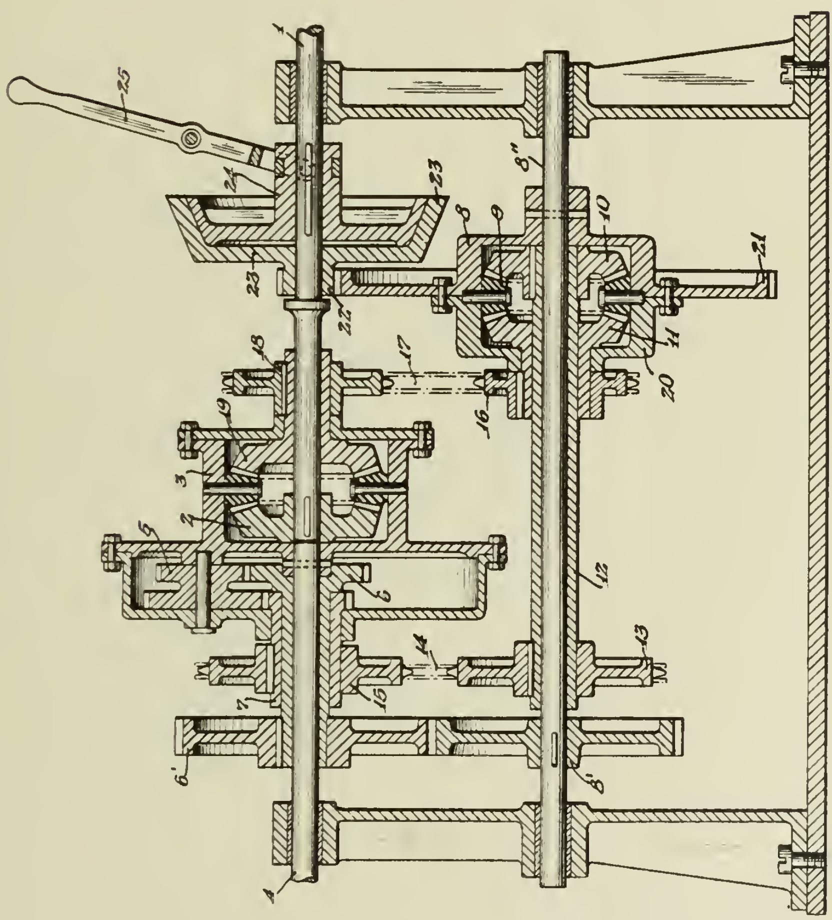


FIG. 6

INVENTOR.

UMBERTO FINZI

BY

Edgar Luzzatto

AGENT

PUBLISHED
JUNE 15, 1943.
BY A. P. C.

U. FINZI
GRADUAL SPEED CHANGING DEVICE
Filed June 8, 1940

Serial No.
339,411
4 Sheets-Sheet 3

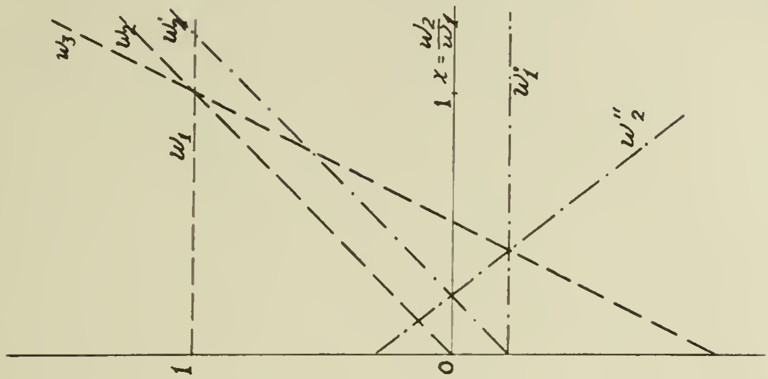


FIG. 9

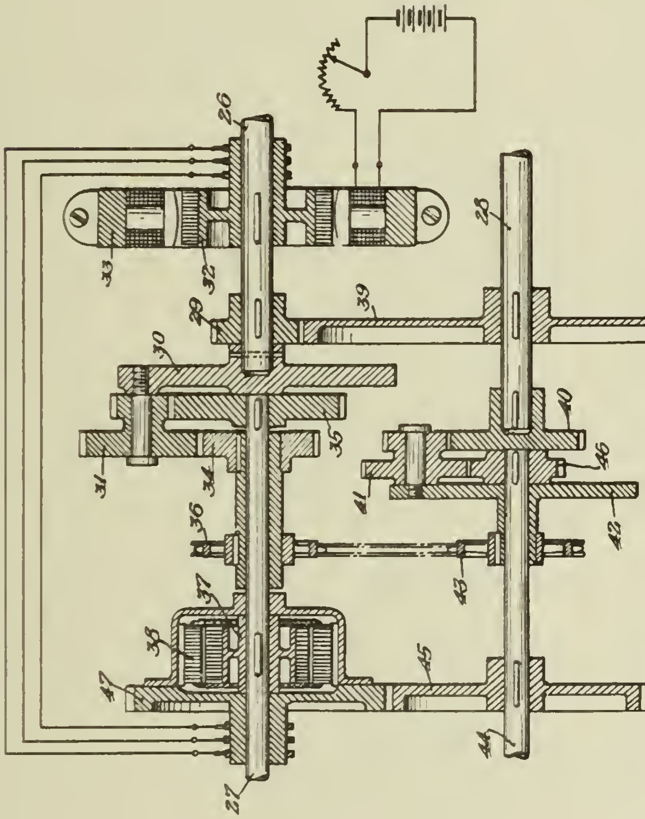


FIG. 8

INVENTOR.
UMBERTO FINZI
BY
Edgar Luzzatto
AGENT

PUBLISHED
JUNE 15, 1943.
BY A. P. C.

U. FINZI
GRADUAL SPEED CHANGING DEVICE
Filed June 8, 1940

Serial No.
339,411
4 Sheets-Sheet 4

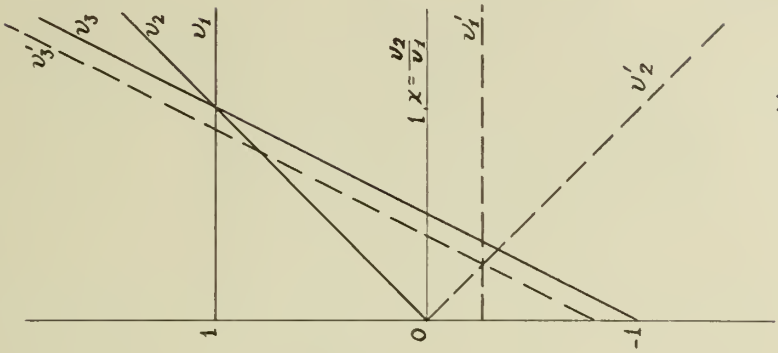


FIG. 11

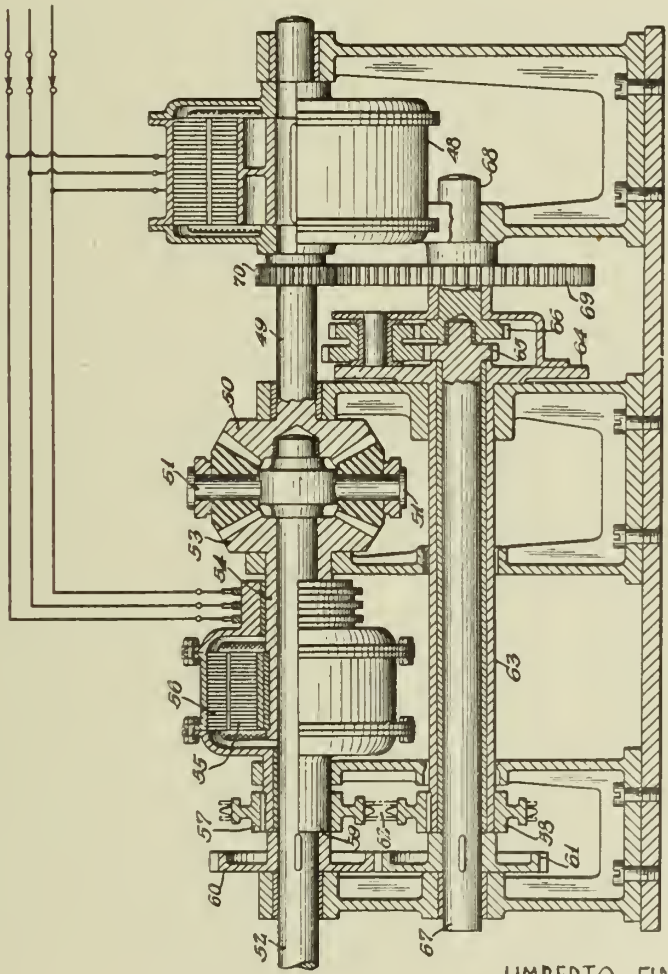


FIG. 10

INVENTOR.
UMBERTO FINZI
BY
Edgar Luzzatto
AGENT

Published June 15, 1943

Serial No. 339,491

ALIEN PROPERTY CUSTODIAN

BASE MATERIAL FOR GRAMMOPHONE RECORDS AND OTHER SOUND RECORDS

Harald Mediger, Dessau, Germany; vested in the Alien Property Custodian

No Drawing. Application filed June 8, 1940

This invention relates to a base material for grammophone records and other sound records and to the manufacture of same, said records bearing on one or both surfaces mechanical sound registrations in form of grooves cut into the material by means of a stylus according to the Edison or to the Berlin method.

It is kown to manufacture grammophone records and sound records on film strips from synthetic materials consisting of vinyl polymers.

Compared with grammophone records manufactured from Celluloid and shellac mixtures, such records have the advantage to be less fragile and chemically more resistant. They are true to scale, but they, too, have the disadvantage to be thermoplastic and to become useless already at relatively low temperatures, for instance slightly above 100°C.

A number of other artificial materials not possessing these disadvantages are not suited for sound records on account of difficulties arising during the manufacturing process.

It is an object of the invention to provide a new and more suitable base material of the above mentioned type for the manufacture of sound records, especially grammophone records.

A further object is to provide a base material highly resistant towards wear and tear and atmospheric influences.

A further object is the provision of an unbreakable material for said records.

These and other objects will become apparent from the following description.

The present invention is based on the observation that grammophone records and other carriers for sound recording are most advantageously manufactured from linear synthetic condensation products, for instance superpolyamides, superpolyesters, superpolyethers, sunperpolyanhydrides, superpolyacetals, polyureas, polyurethanes, polyhydrazides. Such base material for sound records possesses excellent hardness in the finished state, which increases the resistance towards wear and tear and reduces the surface noises to a minimum. Such records are unbreakable, chemically very resistant and, generally speaking, not at all sensitive towards atmospheric influences, for instance moist air. Also their resistance towards higher temperatures is excellent.

These carriers for sound recording according to the present invention may be obtained by casting, if necessary centrifugal casting, by pressing, forming or dye-casting. The grammophone records may be embossed by pressing in the matrix or by cutting with a stylus which may be heated, if so desired. In this case it is advantageous to use a plasticized material. As plasticizers are cited by way of example monomeric ϵ-capro lactam, also solvents in a quantity up to 20%, for instance phenol, o- or p-cresol, o-oxydiphenyl and the like, furthermore high polmeric vinylethers, for instance polymerized bornylvinylether.

Most suitable as base material used in the manufacture of grammophone records according to this invention are for instance the superpolyamides, superpolyesters, superdyethers, superpolyanhydrides and superpolyacetals produced according to U. S. Patents Nos. 2,071,250, 2,071,251, 2,071,252, 2,071,253. Also the polyamides according to U. S. Patent application Ser. No. 225,266, filed July 20, 1938, and the polyamides and polyurethanes according to U. S. Patent application Ser. No. 277,948, filed June 7, 1939, may be employed. Most practical are the interpolymers according to German Patent applications I.63 683, filed February 3, 1939, and I.63 684, filed February 3, 1939, which are completely transparent and most flexible; also interpolymers soluble in alcohol according to German Patent application I.64 433 (24.4.39) which are especially useful for casting grammophone records.

To the substances mentioned above plasticizers, fillers, pigments and the like may be added. Film strips for sound recording consisting of linear synthetic polycondensation products may be oriented by cold drawing which increases their tenacity considerably.

HARALD MEDIGER.

Published June 15, 1943

Serial No. 342,712

ALIEN PROPERTY CUSTODIAN

SIZING MATERIAL FOR SIZING TEXTILE THREADS OF ALL KINDS

Louis Antoine Billion, Lyon, France; vested in the Alien Property Custodian

No Drawing. Application filed June 27, 1940

Products having a base of linseed oil, fish glue, starch and the like are usually employed for sizing natural and artificial textile thread. Certain of these have the disadvantage of causing oxidation of the silk and none forms a coating sufficiently strong to completely protect the textile thread during the course of the operation to which it is submitted.

The object of the present invention is the production of a size which will overcome these disadvantages. It consists in the novel application as a sizing material for any textile thread of the sericine or silk gum which is the natural product surrounding the fibroine of natural silk as a kind of sheath.

This product can be dissociated from the fibroine without the aid of any solvent such as soda, soap or the like which would modify its nature and its physical or chemical properties.

To obtain a product as pure as possible the following operation can be followed:

The sericine is obtained from cocoons, silk threads or waste, flock silk or the like by treatment in distilled or purified water at a temperature of 120° C. in an autoclave under pressure. The solution is subsequently concentrated to obtain a sizing material of a concentration corresponding to those usually employed which can vary from 5% to 20% by weight of the textile material to be sized.

The sizing of the textile threads can be carried out as in the known processes.

The employment of this product is particularly applicable for the sizing of certain of fabrics destined to be used unbleached; and in which the sericine acts as a dressing such as bolting cloth.

Moreover this product has the advantage of considerably increasing the resistance to friction. It allows of the use of textile threads of inferior quality, as for example Canton silk or even the fine threads of rayon in the formation of fabrics where their employment was hitherto prohibited. For all qualities of threads of silk, rayon and the like it facilitates the weaving by allowing an increase in production consequent upon an increase in speed of the looms and the number of looms which can be attended to by the same operative.

LOUIS ANTOINE BILLION.

Published June 15, 1943 Serial No. 345,220

ALIEN PROPERTY CUSTODIAN

METHOD AND APPARATUS FOR THE PRODUCTION OF CURLED THREADS FROM CELLULOSE ACETATE

Georg Rutishauser, Basel, Switzerland; vested in the Alien Property Custodian

Application filed July 12, 1940

The invention relates to a method and an apparatus for the production of curled threads from cellulose acetate.

It is known to utilize the thermoplastic properties of a structure from cellulose acetate or esters which may still contain swelling- or softening-media, in order to impart to these structures a certain shape. In utilizing this property and by means of fluted rolls an undulating, especially a curling, can be produced on an acetate-artificial silk thread.

However, different difficulties occur in such curling methods. If for curling a normal, ready spun, dry thread is employed, the curling is not lasting, or only when high temperatures and pressures are employed which cause damaging of the thread treated in this manner. If a thread, which contains a swelling or softening medium already added to the spinning mass, is treated in a similar manner, difficulties of various kind also result. For instance it easily happens that the threads are stuck the one on the other or on the fluted rolls, so that it is impossible to continually carry out the method, or these swelling and softening media must be removed again after the curling, as otherwise the curling does not last and a thread containing these media shows a much too strong elasticity and results in an unelastic, unsuitable product. If however the swelling and softening media are subsequently applied only externally on to the ready spun thread, such as cellulose acetate, swelling aqueous salt solutions, or mixtures of organic liquids such as, for instance, a mixture of a dissolving or swelling medium for cellulose acetate together with a non-dissolver or filling medium, a treatment of longer duration preceding the curling is necessary with these media and must be very accurately regulated or supervised. This is not simple and requires additional time, arrangement and auxiliary substances. After the curling a retreatment has to take place to liberate the threads from these media.

If in such methods higher spinning speeds are applied such as usual for instance in the dry-spinning method, the above mentioned methods fail as the time during which the swelling media act is too short to enable a sufficient action of the running thread. A finished product insufficiently curled would then be obtained or preliminary and subsequent treating devices would have to be employed.

The invention avoids in a very simple manner these inconveniences and admits of obtaining a regular and permanently lasting curling in that by adjusting the spinning conditions a small portion of its volatile solvent is left in the thread bundle coming out of the spinning shaft, this thread bundle being then sprinkled at once with water, preferably hot water, by means of a moistening device and finally conducted through one or several pairs of heated fluted rolls. The thread bundle thus curled is then cut to the desired staple length immediately and continually. If necessary, a re-drying can take place following on the cutting or later, but this has nothing to do with the curling to be obtained.

In this simple manner it is possible, to obtain on a moving thread bundle of acetate artificial silk a permanent and lasting, very regular curling. Sticking or winding of the fibres on the rolls does not take place. By selection of the fluted rolls the fibres can be set as regards number of curlings per unit of length and shape of the curling arcs (round, flat, acute arcs). If the bundles of thread are conducted between two successive pairs of rolls, the axial planes of which are inclined at an angle the one to the other, or if the thread bundles are turned after the first curling and prior to the introduction into the second, parallel pair of rolls, it is possible to produce, according to the invention, a curling after the manner of a double curve.

The curling thus obtained is even more like the natural wool curling, very lasting and does not disappear by carding or combing in the machine for further treatment. The curled fibres further can be subjected repeatedly to a longitudinal stressing or moistened and dried, colored or otherwise treated without causing the curling to disappear. The curling is permanent and lasting.

The method presents the advantage that it can be applied on to the moving thread bundle, space being saved owing to the simplicity and small size of the treating elements, this having an especially favourable effect if the method is applied to the rapidly running thread bundle.

The threads coming from the spinning shaft are moistened, curled and cut in a continuous operation, so that the curled acetate cellulose wool is obtained quite ready, this being especially valuable for production in large quantities.

The manufacturing process of the ready cellulose wool requires a very short time, only about two seconds being necessary for the spinning, curling and cutting. Owing to these high speeds a machine unit with 100 spinning points turns out per day at least 1000 kg. The several machine elements work so securely and reliably,

that practically no one is required for attendance except for the pressing of the ready bales. The cellulose wools produced according to the new method have an extraordinarily uniform and lasting curling, the curving and the number of curlings being as desired.

The method can be carried out at any spinning speeds usual in the dry-spinning process. For instance a bundle of fibres of 500 to 1000 titre at 3¾ titre per single fibre is spun in any spinning shaft at a speed of at least 150 m. per minute. The drying process in the cell is adjusted so that the delivered thread contains 4 to 10, preferably 6% solvent. In front of the curling roll one or several bundles of fibre of the above titre are moistened with water, preferably hot water, so that they show a water content from 6 to 18, preferably 14%. The fibres then moistened with volatile solvent and water are fed to a pair of curling rolls with 80 to 180, preferably 130° C., this pair of curling rolls rotating at a speed of about 100 m. per minute. The curling which is produced shows 6 to 7 arcs per cm. The cutting machine following on the curling rolls draws the curled bundle off the curling roll in slightly stretching it and cuts the threads in staples of for instance about 120 mm. length.

The accompanying drawing shows by way of example an apparatus for carrying out the method according to the invention.

In this drawing **2** designates the spinning shafts or the drying chambers of the same, **3** the moistening roll, **4** a pair of fluted rolls, **5** another pair of fluted rolls, the axis of the latter pair of rolls being perpendicular to that of the curling rolls **4**. **6** designates the cutting machine and **7** the pile of cut curled wool.

GEORG RUTISHAUSER.

PUBLISHED

JUNE 15, 1943.

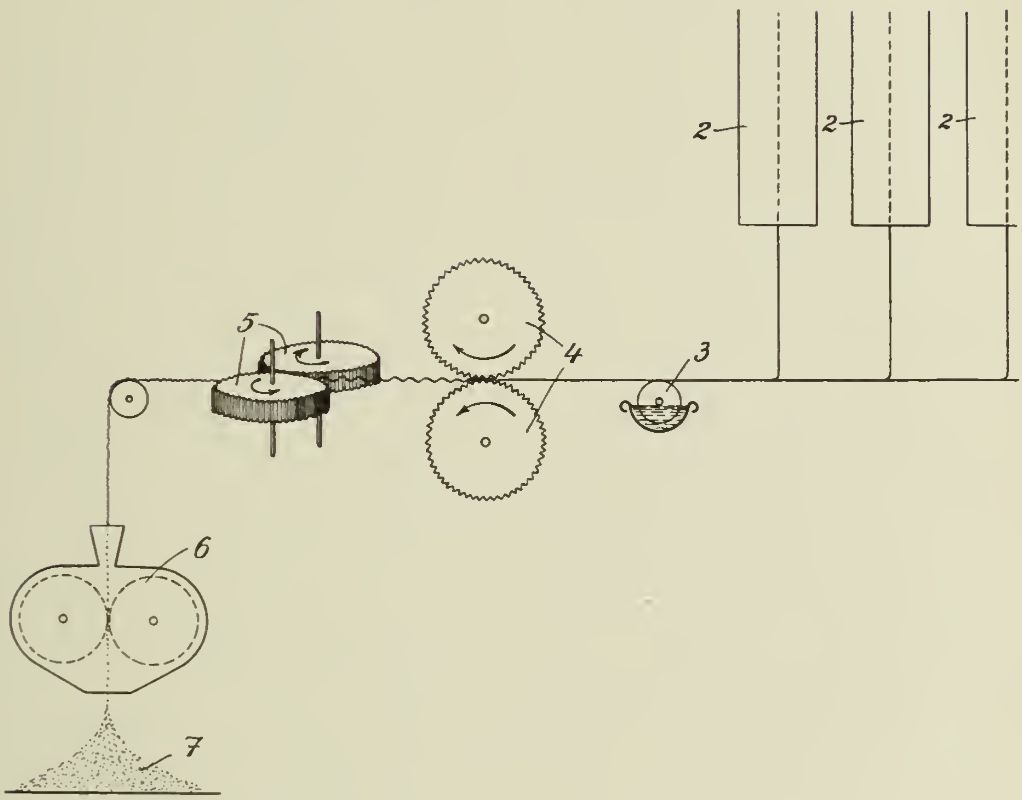
BY A. P. C.

G. RUTISHAUSER

METHOD AND APPARATUS FOR THE PRODUCTION OF CURLED THREADS FROM CELLULOSE ACETATE

Filed July 12, 1940

Serial No. 345,220



Inventor.
Georg Rutishauser
By Bailey & Larson Attorneys

Published June 15, 1943

Serial No. 359,978

ALIEN PROPERTY CUSTODIAN

PROCESS FOR THE ACTIVATION OF NORMALLY LIQUID FATTY MATERIALS CONTAINING UNSATURATED COMPOUNDS

Hein Israël Waterman, Delft, and Cornelus van Vlodrop, Overschie, Netherlands; vested in the Alien Property Custodian

No Drawing. Application filed October 5, 1940

The invention relates to a process for the treatment of normally liquid fatty materials containing unsaturated compounds such as drying oils, semi-drying oils and unsaturated oil fractions, particularly those containing a high content of isolated double bonds, at elevated temperature with sulphur dioxide under pressure as a catalyst.

It is known that by different conversions of oils, especially at elevated temperature, sulphur dioxide is an active catalyst. For instance it is known that it is possible to hard non-drying oils by heating them at temperatures of preferably 100–140° C. under such a sulphur dioxide pressure that the sulphur dioxide remains liquid. In this manner a cis-trans transformation is obtained by which a hardening is caused. An example of such a transformation is the transformation of oleic acid into elaidic acid. Under other circumstances of temperature and pressure drying oils can be polymerised and converted into polymerised oils with the use of sulphur dioxide as a catalyst.

We now have found that in using sulphur dioxide as a catalyst by an adequate choice of the circumstances, such as temperature, sulphur dioxide pressure, and duration of the treatment, it is possible to realise still another reaction in drying oils. By heating of drying or semi-drying oils containing isolated double bonds under sulphur dioxide pressure such a transformation of these oils can be obtained that the isolated double bonds of the acid groups of the drying oils are converted into conjugated double bonds. By this transformation the drying qualities of the oils are modified and linseed oils and oils having corresponding properties are converted into oils showing more resemblance with Tung oil which in general by its high content of conjugated double bonds is more reactive than linseed oil.

The normally liquid fatty materials containing unsaturated compounds, which can be treated according to our invention comprise drying oils, relatively highly unsaturated semi-drying oils, such as soja oil, sunflower oil and fish oils, and relatively highly unsaturated oil fractions, such as fractions of soja oil and herring oil. These relatively highly unsaturated oil fractions may for instance be obtained by separating solid fractions from oils, for instance by refrigeration or extraction or by application of the hardening process according to the British specification 502,390 after separating out the hardened products, or by a combination of these separating methods.

The activated conversion products obtained dry faster than the starting material, their addition of hydrochloric acid is easier and they have a higher diene value (addition of maleic acid anhydride). In contrast to Tung oil the dried film of activated oil does not show the characteristic ice flowers. Moreover the activated products are more resistant to water and sodium carbonate.

By the activation according to our invention polymerisation and formation of substances being solid at room temperature by cis-trans transformation only occur in a low degree. The viscosity of the treated oil shows only a small difference with that of the starting oil and the largest part of the activated product is distilled off by distillation in a high vacuum. The activated oil is further considerably more sensitive for high temperature than the starting oil. From the activated oil a polymerised oil can be prepared in a short time without use of a catalyst.

According to our invention activated oils are prepared by treating the starting oil containing no or a small amount of conjugated bonds in the acid groups at a temperature between approximately 160–230° C., preferably between 180 and 200° C., in the presence of sulphur dioxide, preferably under pressure. By using a higher sulphur dioxide pressure a lower temperature may be used, whereas by using lower pressures higher temperatures may be used. The influence of the temperature and the pressure is illustrated by Table I which relates to the heating of linseed oil under sulphur dioxide pressure for 1 hour.

Table I

Average pressure in kg/cm²	Average temperature in °C	Specific gravity (d^{20}_4)	Refractive index (n^{20}_D)	Iodine value	Acid value
Starting linseed oil		0, 9282	1, 4811	188, 5	-------
100	175	0, 9376	1, 4886	156	2, 2
34	182	0, 9318	1, 4859	171	2, 2
104	200	0, 9478	1, 4923	127	8, 4
33	208	0, 9504	1, 4920	117	10, 8
37	217	0, 9422	1, 4902	145	8, 0

For obtaining good yields the oil has to be treated for from 5 to about 10 minutes or more at the temperature mentioned. We have found, however, that the present conversion has a normal thermal coefficient, so that by the use of higher temperature the conversion can be considerably accelerated, as Table II shows for linseed oil.

Table II

Temperature in °C.	Pressure in kg/cm²	Reaction time in minutes	Proportion of the number of cm³ of oil (measured at room temp.) and the number of cm³ of liquid SO_2	Refractive index (n^{20}_D)	Specific gravity (d^{20}_4)
212	100	30	70:20	1,4917	0,9448
225	110	15	70:18	1,4918	0,9442
225	130	10	30:32	1,4914	0,9415
225–230	100–200	15	90:10	1,4911	0,9444

Finally Table III shows that the products prepared at for instance 190°C and 225°C correspond closely.

Table III

Temperature in °C	Reaction time in minutes	Pressure in kg/cm²	Refractive index (n^{20}_D)	Specific gravity (d^{20}_4)	Diene value
Starting linseed oil			1,4813	0,9292	
190	30	80	1,4873	0,9343	16
	45	75	1,4881	0,9349	17
	60	72	1,4889	0.9365	20
	90	70	1,4903	0,9396	20
225	8	90	1,4880	0,9353	18,5
	13	90	1,4909	0,9403	20,5
	22	100	1,4926	0,9545	18

By the use of an adequate high temperature, therefore, it is possible to accelerate the conversion in such a manner that the process can be continuously carried out.

It is recommendable to remove the peroxides from the unsaturated fatty oils previously to the heating with sulphur dioxide.

This can be carried out in a known manner by treatment at elevated temperature, for instance at 290°C and passing a stream finally divided indifferent gas, e. g. nitrogen, through the oil.

By application of our invention and an adequate choice of the temperature and the sulphur dioxide pressure besides the transformation of the isolated double bonds into conjugated double bonds only relatively small polymerisation and a small separating out of solid matter by cis-trans transformation occur.

The invention is further elucidated but not at all limited by the following examples:

Example I

In order to remove the peroxides present linseed oil is heated at 290°C under passage of a stream finally divided nitrogen through the oil. After treatment for a quarter of an hour the oil is cooled down to about 196°C, thereupon brought under a sulphur dioxide pressure of about 150 kg/cm² and heated for an hour under these circumstances at the temperature mentioned. The activated oil dries quicker than linseed oil, the film formed does not show the ice flowers being characteristic for Tung oil. The diene value is increased from about 2 to 25,5.

Example II

A linseed oil being treated according to Example I for the removal of the peroxides is heated during one hour at 175°C under a sulphur dioxide pressure of 100 kg/cm². The product obtained dries much faster than linseed oil, but does not form ice flowers.

Under lower sulphur dioxide pressure, however, already perceptible results can be obtained; for instance by heating at 193°C under a sulphur dioxide pressure of 42 kg/cm² a considerable increase of the diene value and of the drying velocity are obtained. Besides the acceleration of the drying and the transformation of the isolated double bonds into conjugated double bonds here also only a weak polymerisation and separation of only a small amount of solid matter by cis-trans transformation occur.

Example III

From soja oil a liquid fraction having a relatively high iodine value is prepared in the following manner. The soja oil is first heated during half an hour at 180°C under passage of a stream of nitrogen for the removal of the peroxides. Thereupon 550 g sulphur dioxide are added to 800 cm³ of the so-treated oil and the mixture is heated for 3 hours at 110–115°C. The reaction product is separated into a solid and a liquid fraction by crystallisation from acetone. The liquid fraction then is activated according to our invention by heating at about 200°C under a sulphur dioxide pressure of 75–80 at for one hour. Table IV gives a comparative survey of the properties of the several products involved.

Table IV

Product	Per-cent	Technical melting point in °C	Acid value	Iodine value	Refractive index (n^{20}_D)	Spec. gravity ($d^{20}/_4$)	Drying test (entirely dry after:)	Viscosity in poises (20° C)
							Days	
Soja oil			0, 3	136, 5	1, 4759			
Reaction product hardened with SO_2		18, 9	0, 5	135	1, 4751			
Obtained by crystallisation from acetone:								
Solid fraction	37	26, 1		111	1, 4720			
Liquid fraction	63		0, 6	148, 5	1, 4763	0, 9217	9	1
Liquid fraction activated with SO_2				124	1, 4840	0, 9302	3, 5	2

Various changes may be made in the details disclosed in the foregoing specification without departing from the invention or sacrificing the advantages thereof.

HEIN ISRAËL WATERMAN.
CORNELUS VAN VLODROP.

Published June 15, 1943

Serial No. 346,964

ALIEN PROPERTY CUSTODIAN

RESERVOIRS FOR FLUID FILLED CABLE

Walter van den Berg, Koln-Mulheim, Germany; vested in the Alien Property Custodian

Application filed July 23, 1940

In fluid filled electric cable installations, as the cable heats and cools with changes of load thereon, expansion and contraction of the impregnating medium takes place. To avoid undue changes of pressure within the conductor enclosure, means are provided to receive the fluid medium from the cable as it expands and to feed it back to the cable as its temperature and that of the cable decreases. To accomplish this variable capacity, reservoirs are employed in which a gas under pressure is employed as a yieldable means to accommodate any increase in volume of the impregnating material and to feed it back to the conductor enclosure as it contracts. Care must be exercised to prevent the gas from mixing with the impregnating material. As ordinarily constructed, these reservoirs are expensive and require the utmost care in their manufacture, and usually a considerable amount of special manufacturing apparatus.

The object of my invention is the provision of an improved reservoir which is simple in construction, reliable in operation, and of relatively low initial cost.

For a consideration of what I believe to be novel and my invention, attention is directed to the accompanying description and the claims appended thereto.

In the attached drawing, which is illustrative of my invention, is shown a reservoir in vertical section.

The reservoir comprises a tank having a cylindrical wall 1 of relatively thin metal, a bottom wall 2 which is curved inwardly to give it the necessary strength to resist internal pressure which is above that of the atmosphere, and a cover 3. Inside of the casing so formed is a ring 4 which is brazed or otherwise secured thereto in a manner to provide a fluidtight joint. Inside of the casing is a cylinder 5 of heavier metal which has a carefully smoothed inner surface as it is on that surface that the free piston 6 moves up and down. It is important to make the inner surface smooth for upon it in large measure depends the separation of the gas in the chamber 7 above the piston and the liquid or other fluid from the cable in the chamber 8 below the piston. This chamber is in free communication with the tank chamber 9, as for example through lateral openings 10, the effect of which is to greatly enlarge the cubical contents of the retaining or storage space for cable liquid. The upper end of the cylinder is supported by the ring 4 and the two parts are united by a brazed or welded joint 11. The upper end of the cylinder and the inner part of the top surface of the ring are chamfered to receive a compressible packing 12 which engages the under surface of the cover 3, the latter being clamped in place by an annular series of clamping bolts 13 which enter the ring. Gas under positive predetermined pressure is admitted to the piston chamber 7 by suitable means, such as the pipe 14, having any usual form of shutoff means. The bottom wall 2 of the tank has a piston stop 15 of suitable construction, in this case a ring which is brazed or welded to the wall. Liquid or other fluid from the cable is admitted to the chambers 8 and 9 through the pipe 16. The stop prevents the piston when in its lowermost position from interfering with the admission of fluid to the chamber 8 from the cable.

The free piston 6 comprises top and bottom plates 17 and 18 between which are located a number of floating rings 19, two being shown in the present illustration. Each ring has a pair of oppositely inclined or beveled peripheral surfaces 20 for engagement with packing rings 21 which are made of material that is somewhat elastic. The top and bottom plates or heads are also provided with beveled faces or surfaces 22 which cooperate with the surfaces 20 to force the packing rings outwardly into contact with the wall of cylinder 5. The floating rings and the end plates have cooperating engaging shoulders 23 and 24 which prevent undue lateral displacement of one part with respect to another, especially when pressure is applied to the plates. Each floating ring has shoulders on opposite sides thereof, one shoulder such as 24 engages a flange on a head while shoulder 25 engages a shoulder on the adjacent ring. The packing rings are of trapezoidal cross-section, are fitted into substantially conical recesses, and are pressed tightly against the wall of the cylinder by a wedging action due to the beveled or coned surfaces, for example when the upper plate 17 is subjected to gas pressure and the lower plate 18 to cable liquid pressure. The packing rings may be made of rubber where the fluids to which they are exposed do not adversely affect them, or they may be made of any other convenient artificial material which is resistive to the action of fluids or other of them.

The plates are loosely connected which permits of a limited freedom of movement of the floating rings 19. This has the advantage of equalizing the pressures on the packing rings instead of causing a higher pressure at one region over that of another. To accomplish this, the

upper plate 17 has a hub-like socketed center which is screw threaded to receive and retain the threaded part of member 26. The member has a sleeve-like extension in which is located a cylindrical element 27, the two parts having an easy sliding fit. The sleeve has a slot 28 to receive an end of a pin 29, the slot walls and the pin limiting the maximum separation of the end plates and preventing relative angular movement of the parts. The lower plate has a hub-like socketed center portion which has a screw threaded opening to receive the lower end of the cylindrical part 27. The screw threaded arrangement permits of a limited amount of vertical adjustment. As indicated, the arrangement above described permits of limited independent movements of the heads and rings. Because the heads and floating rings are not positively connected, the pressures on the several packing rings are equalized both vertically and laterally with the result of affording a complete separation of the gas and cable liquid. Stated another way, the floating rings have a limited amount of play. The top and bottom plates have smooth edges and make an easy fit within the cylinder so that they will not injure the smooth surface of the cylinder wall as the piston moves up and down. As will be noted, the end plates are always under pressure when the reservoir is in use, the pressures acting in opposite directions. As the cable liquid or fluid expands, the free piston is pushed upwardly in opposition to the gas pressure in chamber 7. When the cable fluid contracts, the gas pressure forces the piston downward and thus the cable fluid is maintained under the predetermined positive pressure and the formation of voids or gas containing spaces in the cable prevented. I have described the chamber 7 filled with gas and chambers 8 and 9 with cable fluid but this arrangement can be reversed. The free piston being constantly under opposing fluid pressures, the packing will always be under pressure and in contact with the cylinder wall. As a result of this, there will be at all times a complete separation of the fluids and there will be no opportunity for one fluid to leak into the other. There will be very little tendency in this respect for the pressures quickly become equal and opposite.

My invention has been described in connection with a cable but it may be used with other types of electrical apparatus where separation of two fluids, both under pressure, is desirable.

WALTER VAN DEN BERG.

PUBLISHED

JUNE 15, 1943.

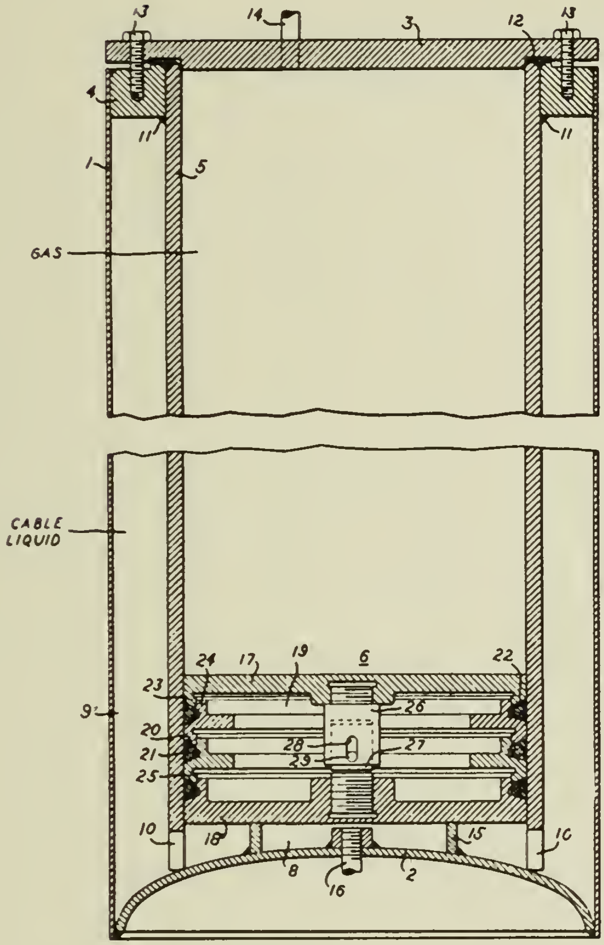
BY A. P. C.

W. VAN DEN BERG

RESERVOIRS FOR FLUID FILLED CABLE

Filed July 23, 1940

Serial No.
346,964



Inventor:
Walter van den Berg.
by Harry E. Dunham
His Attorney.

Published June 15, 1943

Serial No. 360,215

ALIEN PROPERTY CUSTODIAN

SWITCHING-CASE FOR ELECTRIC POCKET LAMPS

Emile Venot, Marseilles, France; vested in the Alien Property Custodian

Application filed October 8, 1940

Actually and in a general way, it is known of disposing on one side of the case of an electric pocket lamp, a switch the working of which aims at realizing ignition or extinction of the lamp.

This switch is provided with an indispensable organ of prehension always jutting out from the case. Now, experience sufficiently proved that this classis means of realizing a switch offers certain inconveniences, the principal of which are, first, a certain difficulty for moving the cut-out requiring very often for this operation, owing to a little stiffness in the working of the switch, the use of both hands, one, to hold the case, the other to move the switch; then, the jutting out of the organ of prehension of the switch, is a cause of hooking other objects being in the same pocket of the dress containing the lamp, which also may be the cause of trouble, and finally the adjustment of the strip of the pyle corresponding with the interruptor, each time the pyle is replaced.

Those risks and principal inconveniences are now suppressed by the object of the present invention, consisting essentially in a case of electric pocket lamp a part of which is movable with the precise aim of constituting a switch without any control organ jutting out, placed in the electric circuit feeding the lamp.

This case is characterized by the fact that the electric lamp is movable and that its bottom constitutes at the same time owing to this moving, a sliding contact on one of the conducting blades of the pyle and a thrust block limiting its moving by meeting the other blade likewise conducting. This meeting leading to ignition of the lamp and its removal to extinction.

The switching case for electric pocket lamp is shown on the joined drawings, given as an example of execution of one of the forms of the object of the invention.

According to these drawings

Fig. 1, essentially schematic, shows the principle of the invention itself.

Fig. 2 is a view from the front, with parts cut off, in order to make comprehension easier, of a practical realization of the switching case.

Fig. 3 is a view from the side, likewise with parts cut off, of the switching case shown on Fig. 2.

Fig. 4 shows the same switching case seen on plan.

Considering Fig. 1 schematic, it is noticed that a lamp 1 is fixed by known means, in preference by screwing, on a support 2. This support is movable, consequently it may be moved longitudinally and alternately following the direction of the arrows A and B, and that the lowest part of the bottom 3 bearing plot 4 of lamp 1 is always in contact with a blade 5, flexible and current conducting connected with one of the poles of an electric source, 6 whilst bottom 3 itself is in contact with a blade 7 likewise conductor, connected also with the electric source 6 and forming the other pole.

It is obvious that in this position, the electric circuit is closed upon the connections of lamp 1 and that this latter will light. But if support 2 is pushed in the direction of arrow A, position shown by a dotted line, it immediately will result that bottom 3 leaving its contact with blade 7 will cut off the electric circuit, and by this fact lamp 1 will extinguish. That is the principle and the working of the switching case, a practical realisation of which is shown on Fig. 2, 3, 4.

In this practical realization, case 8 and support 2 of lamp 1 are more favorably constituted of moulded and insulating materials or of wood. Support 2 slides inside case 8, position shown in dotted line on Figs. 2 and 4, guided by slots 9 of convenient shape, more particularly visible on Fig. 3, which allows to displace longitudinally and by sliding bottom 3 and its plot 4 of contact with blade 5 conductor of pyle 6, and to come likewise in contact with blade 7 according to the principle of the invention and to its working, already described and shown on Fig. 1.

To change the pyle 6, when used out, lens leave case I and pyle 6 is easily removed and replaced. Inverse operations bring the switching case back to its state of working.

The switching case realizes a progress in this kind of appliances by suppression of the ancient switch and of the inconveniences it brought with it, and realizes likewise a new result in handling pocket lamps, since ignition and extinction of these latter may realized now and in any easy manner, with a single hand. However, the shapes, the sizes and the materials used for the manufacturing of this switching case may vary without changing the general disposition of the just now described invention.

EMILE VENOT.

PUBLISHED
JUNE 15, 1943.
BY A. P. C.

E. VENOT
SWITCHING-CASE FOR ELECTRIC POCKET LAMPS
Filed Oct. 8, 1940

Serial No.
360,215

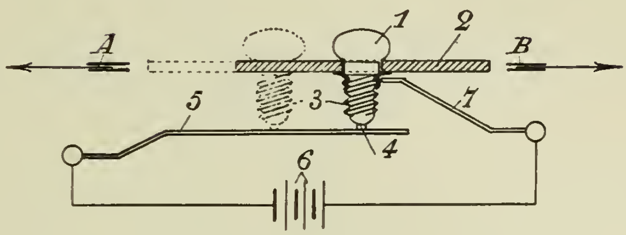


Fig.1.

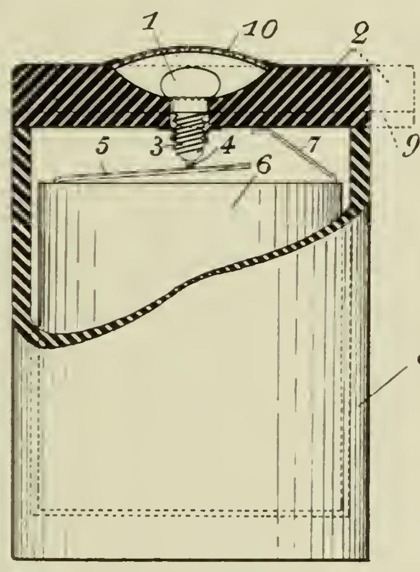


Fig.2.

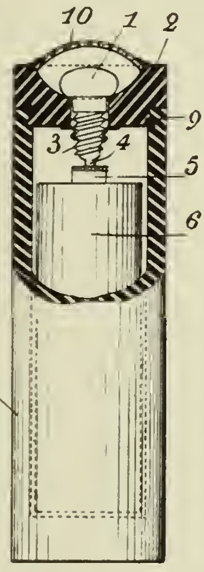


Fig.3.

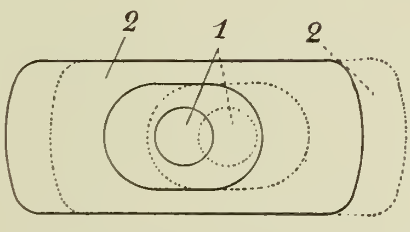


Fig.4.

INVENTOR:
EMILE VENOT
BY Haseltine, Lake & Co.
ATTORNEYS

Published June 15, 1943

Serial No. 364,305

ALIEN PROPERTY CUSTODIAN

ELECTRICAL MUSICAL INSTRUMENTS OF THE KEYBOARD TYPE SUCH AS ORGANS

Christopher Hook, Thiers, France; vested in the Alien Property Custodian

Application filed November 4, 1940

This invention relates to electrical musical instruments of the keyboard type in which notes are produced by electrical alternating current frequencies under the control of the keys of the keyboard, the electrical impulses being transmitted to electrical sound-producing apparatus which is responsive thereto. The main object of the invention is to provide an improved instrument of this type which can produce individual tones and a variety of compound tones of greater perfection than has hitherto been possible, thereby in the latter connection achieving greater fidelity in simulating various musical instruments.

According to the invention the method of producing notes under keyboard control consists in generating alternating current frequencies having the required note frequencies, by causing continuously moving elements having graphical impressions of the said frequencies or co-acting with stationary elements having such impressions to vibrate light beams propagated towards a photo-electric cell or cells or equivalent light-sensitive current-generating or controlling device or devices, transmitting the resulting electrical impulses to electrical sound-producing apparatus, and arranging the keys of the instrument to control the light beams.

The invention also consists in the provision of an instrument constructed to operate according to such method and which accordingly comprises a plurality of light sources arranged to propagate light beams towards a photo-electric cell or cells or equivalent light-sensitive current-generating or controlling device or devices, a plurality of elements having graphical representations of the required note frequencies and which are adapted to vibrate the light beams, keyboard-controlled means for controlling the propagation of the light beams, and electrical sound-producing apparatus to which are transmitted the alternating current frequencies emanating from the photo-electric cell or cells or the equivalent thereof.

The keyboard-controlled means for controlling the propagation of the light beams preferably is such that control is exercised on electric lamps constituting the light sources so as to bring same into operation as required, although alternatively the keys could be arranged to actuate interceptor means normally positioned in the paths of continuously projected beams and adapted to be selectively withdrawn therefrom to allow the beams to be projected on to the photo-electric cells.

Each of the elements having a frequency graphically represented thereon preferably has said frequency photographically impressed thereon and in carrying out the invention it is preferred to provide a series of rotary discs to constitute the said elements, each disc being formed with concentric rings of frequency impressions although, as an alternative, each of the said elements may consist of a continuously driven endless film band.

The invention, although applicable to an instrument for producing simple tones, i. e. having single notes assigned to different keys, is more particularly concerned with producing an instrument which will produce, by the depression of a single key, not only a pure fundamental note or tone but also harmonies thereof resulting in a compound tone of great purity, the invention having provision for varying the relative amplitudes of the harmonics so that numerous effects are obtainable. A further feature consists in providing for reading either a single frequency impression or a group of frequency impressions pertaining to a fundamental and harmonics thereof at a plurality of points which are in out-of-phase relation, that is to say one reading is in out-of-phase relation to the other reading, although the invention also contemplates arranging for such readings to take place in phase and provides also for varying the degree of phase.

Further features of the invention consists in the construction of apparatus provided for carrying out the invention and in methods employed for producing the frequency rings and apertures of a fixed plate co-acting therewith, whilst still further features by which the invention is characterised will become apparent from the following description.

Reference is directed to the accompanying diagrammatic drawings, wherein:

Figure 1 is a view of the installation according to one embodiment of the invention, showing one of the keys and associated arrangements for producing a compound tone, i. e. a fundamental and harmonics thereof on manipulation of the key.

Figure 2 is a view showing an alternative manner of arranging for the production of a fundamental note and its harmonics,

Figure 3 is a fragmentary sectional view showing the arrangement of the frequency impressed disc, lamps by which the light beams are propagated and a fixed apertured reading plate which co-acts with the frequency-impressed disc.

Figure 4 is an elevation showing in addition to the elements of Figure 3 the disposition of a

photo-electric cell and a reflector for directing the light beams thereto,

Figure 5 is a fragmentary plan view of the frequency-impressed disc, and

Figure 6 is a fragmentary plan view of the apertured reading plate.

Referring firstly to Figure 1, one of the keys 10 of a keyboard is adapted to serve as a switch so that when depressed it simultaneously closes circuits of lamps 11, 12 and 13. Said lamps are fed from an electric battery 14 or other source of supply through a common lead 15, a contact plate 16 contacts 17 adapted to be engaged by said contact plate 16, branch leads 18, 19, 20 and a common return lead 21. If so desired, a variable resistance 22 may be incorporated in the lead 15 or return lead 21 for simultaneously varying the illuminating intensity of all of the lamps 11, 12 and 13, or in the case where an electric battery forms the course of supply, the lead 15 or return lead 21 may be connected to an intermediate tapping of the battery for the same purpose. Fixed resistances 23 may be incorporated in the branch circuits to the lamps for adjusting the relative intensity thereof. Any equivalent switch means may be substituted for the contact plate 16 and contacts 17.

The apparatus for generating electric alternating currents having the frequency of a required musical note, and for translating into sound the impulses thus generated, comprises in conjunction with a group or groups of lamps, a stationary apertured plate 24, the apertures of which coincide with the light beams to permit passage thereof, a continuously rotating disc 25 having rings of openings therein constituting frequency impressions, a concave reflector 26 which preferably but not essentially is constituted by a mirror, a photo-electric cell 27 positioned at the focal point of said reflector and an amplifier and sound-reproducer indicated in general by reference 28.

Referring now to Figure 3 the disc 25 is secured to a vertical shaft 29, and above said disc is disposed a box-like structure 30 suitably supported in a fixed position. Said structure 30 is fitted with a plurality of tubes 31 in which are fitted lamps 11, 12, 13 respectively. Said tubes constrain the light rays to pass to apertures 32 which are formed in the plate 24, said plate constituting the bottom of the structure 30.

In the disc 25 are formed rings of beam-controlling openings 33 which are concentric with the shaft 29 and arranged in register respectively with the light-beam conveying tubes 31. As shown in Figure 5, the openings 33 are of sine-wave form, and they are spaced apart the distance of a complete wave. All of said openings in a given row are identical to one another so that the modulation of a light beam by said openings results in the production of a musical note of predetermined and constant pitch. Said openings contained in a single row, co-operate in turn with an aperture 32 (or with each aperture of a set of apertures) assigned to said row. Said aperture 32 (or each thereof) is substantially rectangular shape, see Figure 6, and has a length equal to that of one of the sine-wave openings 33 with which it co-operates. If there are two or more apertures assigned to each row of openings 33, then same may have an out-of-phase relationship with respect to the said openings 33 as shown in Figure 5, but an in-phase reading can be alternatively arranged for. If out-of-phase relationship is required then suitable provision may be made for varying the degree to which the readings are out of step.

In the arrangement shown in Figure 1, the fundamental note and harmonics thereof are selected from different discs 25 whereas in the arrangement shown in Figure 2 one and the same disc is used for the fundamental and harmonics thereof. In this case the group of lamps 11, 12 and 13 to any required number conveniently may be arranged in a radial line (Figures 2 and 3) and there may be two or more of such radial lines if the rings of frequency-impression openings 33 are to be read at two or more positions as above set forth. The diameter of the discs may be such as to provide for other concentric rings of frequency-impression openings 33 in addition to those pertaining to a particular fundamental and its harmonics, and further the lamps which are arranged in a radial line need not necessarily pertain to a fundamental and harmonics but may pertain to any arrangement of musical notes for individual operations. A considerable number of rings of frequency-impression openings 33 can be assigned to a single disc.

In Figure 4 is clearly shown the manner of arranging the photo-electric cell 27 and the concave reflector 26. The cell 27 is situated as close as possible to the underside of a fixed base plate 34 by which shaft 29 is supported, said base plate being so formed or arranged as not to obstruct the light beams. A concave reflector 26 which preferably is of elliptical form is suitably supported at such a position that the photo-electric cell 27 lies at the focal point of said reflector. Thus the reflector will serve to reflect and concentrate all of the light beams on to the cell 27. If so desired, an optical condenser may be fitted above or below the base plate 34 for concentration of the light rays during their passage to the reflector.

In the arrangement shown in Figure 2 the return leads 35 from the lamps 11, 12 and 13 are selectively adjustable along a resistance 36 (or may be selectively connected to different tappings of battery 14) in order to adjust the relative intensity of the different lamps, but alternatively fixed resistances 23 could be employed as in Figure 1. Likewise the arrangement of leads 35 in conjunction with resistance 36 may be used in the arrangement shown in Figure 1 in substitution of the fixed resistances 23. The variation of the relative intensities of the light beams and consequential relative strengths of the fundamental and associated harmonic notes will enable an infinite variety of different tones to be obtained.

Instead of providing only a single lamp in each of the tubes 31 there may be arranged therein a plurality of lamps at different positions in the length of the tube. In this case the lamp nearest the disc 25 may serve for an unison reading for the appropriate musical note and a more distance one may serve for the production of the same note when used as a borrowed harmonic to another note. Or, one of said lamps may be wired to a key of one keyboard and another to a key of a different keyboard of the same or a different musical instrument.

As a modification to the employment of a flat frequency-impression disc 25 and the concave reflector 26 for directing the light beams on to the cell 27, there may be employed a frequency-impressed disc of part-spherical shape having the cell at the centre of curvature thereof, the fixed plate 24 having the light apertures 32 being

of corresponding arcuate shape and disposed outside the said frequency-impressed disc with the light tubes 31 radially arranged with respect to the cell. Thus the light rays will converge to the cell.

It is pointed out that the required volume of tone can be obtained without excessive amplification of the generated electric currents. This is due to the fact that large reading apertures 32 are provided in the plate 24. Such large apertures are permissible since each aperture only has to handle a predetermined and constant frequency. Thus, as compared with the scanning of cinematograph sound films where a very small scanning slot has to be employed having a width not exceeding that of the smallest wave of the constantly varying wave form, the same volume can be obtained with much less amplification and consequently with appreciably less distortion, since a considerably greater quantity of light flux is able to pass.

Although in the arrangements above described and shown the openings 33 constituting the frequency impressions are formed in the rotary disc 25 and the apertures 32 which co-operate therewith are formed in the stationary plate 24, the arrangement may be reversed, i. e. the stationary plate 24 may have the frequency-impression openings 33 formed therein, the co-operating openings 32 being formed in the rotary disc 25. In either case there will be the same modulation of the light beam.

It is also to be understood that although in the arrangements above described the harmonics are obtained by utilising a series of rings of frequency-impression openings 33 pertaining to the group of notes comprising the fundamental and harmonics, the invention also contemplates as an alternative thereto, forming the said openings 33 as compound wave forms so as to produce the fundamental note and harmonics by openings of a single row.

In playing the instrument, the player regulates, by means of stop keys, the strength of the electric current which is to flow to the lamps thereby regulating the strength of the fundamental notes and correspondingly adjusting the strengths of harmonics. In order to vary the tone, for instance in simulating different musical instruments, the strength of the currents passing to the lamps utilised for the harmonics are adjusted relatively to the fundamental and to one another through the medium of the resistances provided. The keys are then depressed in playing the instrument and the actuation thereof closes the electric circuits with consequent lighting of the appropriate lamps, and modulation of the light beams produced thereby, such modulation resulting from the co-operation of the frequency-openings 33 and light apertures 32. The modulated light rays are reflected by the reflector 26 and thereby concentrated on the cell 27. Electric impulses are consequently generated by the cell 27 having the frequencies of the required tones and such impulses are converted into sound by the electric reproduction apparatus 28 which can be of any known form. The frequency of the note produced will depend, of course, on the speed of rotation of the disc 33 and this speed is maintained constant, the rate being predetermined. The only motion involved (apart from the constant rotation of the disc 25) when playing the instrument is the movement of the keys and the stops used for varying the strengths of the currents passing to the lamps; thus negligible wear is involved.

A feature of the invention is the method of forming the rotary disc with the frequency openings. The said openings are produced photographically and accordingly said disc is a transparent member coated with light-sensitive material, adjoining sectors thereof along an individual ring of frequency impressions being successively exposed to the same negative. The sector thus progressively reproduced subtends an angle such as to contain several sine-waves. The same negative may embody portions of other frequency impression rings contained within the same sector so that the whole disc is produced by a single sector-by-sector printing operation but preferably each frequency ring is built up in turn from an individual negative. As a modification all of the frequency impressions may be simultaneously produced in a single step by photographing a drawing or other original containing the entire layout of such impressions.

The openings 33 which are formed as above consist of transparent portions in a black disc although as a modification they may take the form of opaque markings on a transparent disc.

Preferably, the apertures 32 in the fixed reading plate 24 also are formed photographically, said plate being a transparent member coated with light-sensitive material which is exposed to a drawing or other original or negative taken therefrom.

As an alternative to the above methods of production of the disc 25 and plate 24, the openings and apertures thereof may be stamped out or otherwise cut away.

By way of example, the discs 25 can be made of a diameter to contain a considerable number of frequency rings, so that only a few rings, say four, are required to embrace 8 octaves.

Although the invention is mainly applicable to organs it can nevertheless be applied to other instruments having a single keyboard or plurality thereof. The instrument may be constructed for operation by two or more players operating on the same sets of lamps and set of discs. Thus an orchestra of players can set up the required additive effects pertaining to different instruments, this being permitted by the out-of-phase reading of the discs. True harmonics as distinct from borrowed harmonics may be obtained by adding fresh sets of discs and regulating their speeds to give the required notes.

CHRISTOPHER HOOK.

PUBLISHED

JUNE 15, 1943.

BY A. P. C.

C. HOOK
ELECTRICAL MUSICAL INSTRUMENTS OF THE
KEYBOARD TYPE SUCH AS ORGANS
Filed Nov. 4, 1940

Serial No.
364,305

2 Sheets-Sheet 1

FIG.1.

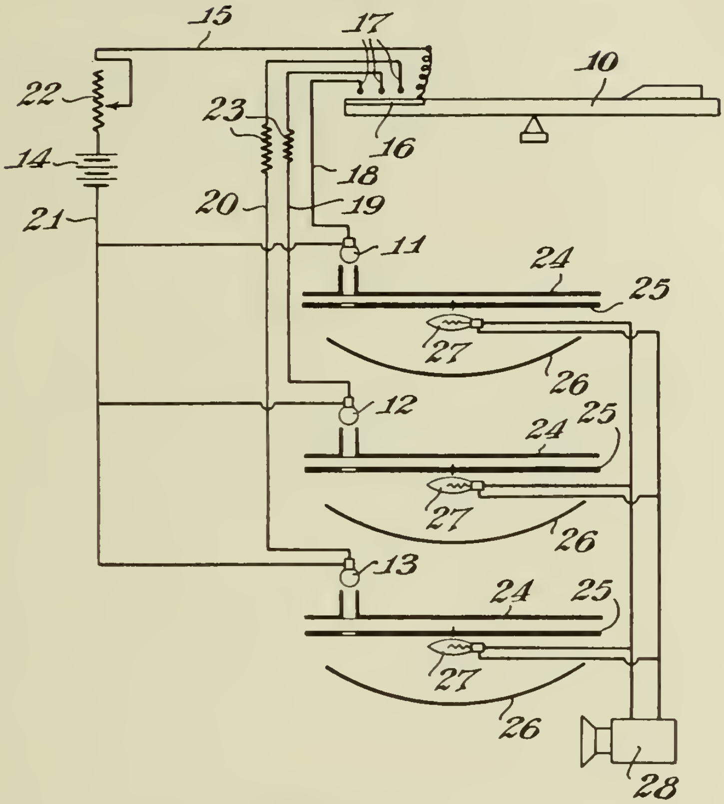
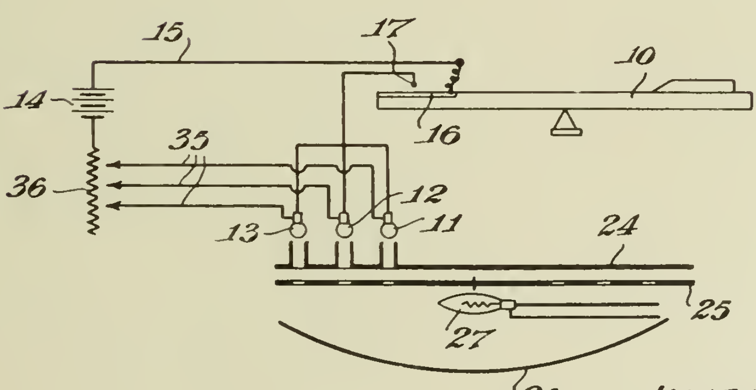


FIG.2.



INVENTOR
CHRISTOPHER HOOK
By Wallace Graff Attys

PUBLISHED

JUNE 15, 1943.

BY A. P. C.

C. HOOK
ELECTRICAL MUSICAL INSTRUMENTS OF THE
KEYBOARD TYPE SUCH AS ORGANS
Filed Nov. 4, 1940

Serial No.
364,305

2 Sheets-Sheet 2

FIG. 3.

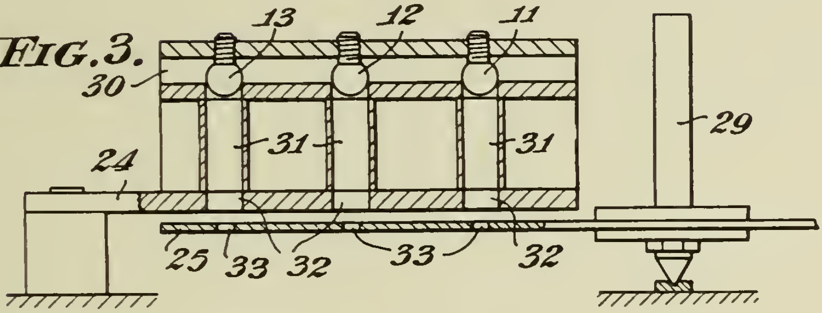


FIG. 4.

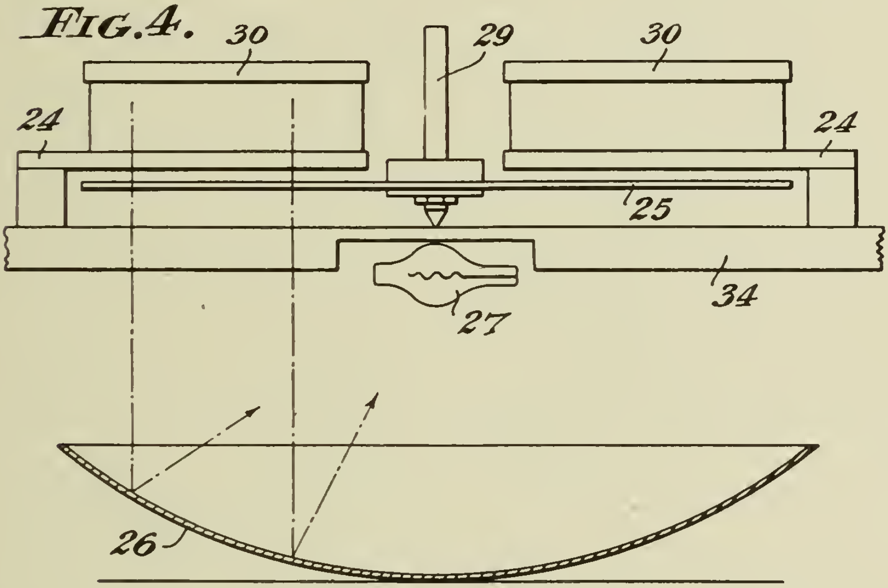


FIG. 5.

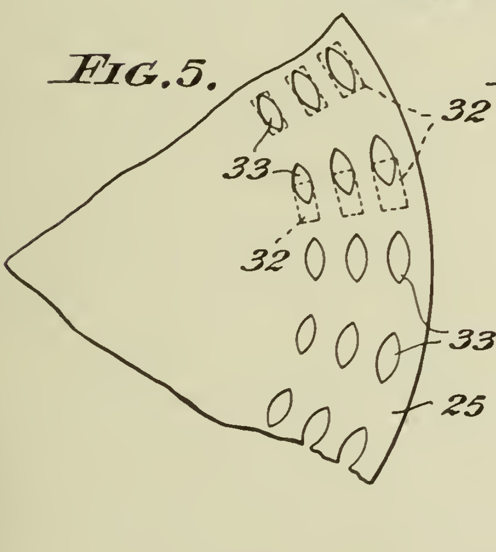
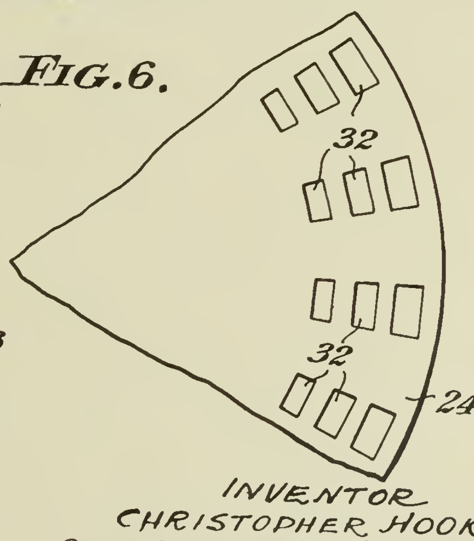


FIG. 6.



INVENTOR
CHRISTOPHER HOOK
By Wallenstein & Groff Attys

Published June 15, 1943 Serial No. 366,503

ALIEN PROPERTY CUSTODIAN

PROCESS FOR PLASTICALLY REPRODUCING OBJECTS

Isao Morioka, Tokyo, Japan; vested in the Alien Property Custodian

Application filed November 20, 1940

The present invention relates to a process for plastically reproducing objects.

The invention has for its object to sculpture busts or statues all alike to objects to be reproduced.

The process of the invention consists of four steps to be carried out in succession.

The apparatus necessary for the first and second steps consists of a set of more than three cameras and more than two projectors installed around a photographing axis of a vertical slender line indicating an upper and a lower point on itself.

In this case each of said projectors is so arranged as is capable of projecting the image of a screen provided with many stripes or points thereon.

Namely, in the first step, only the photographing axis of said slender line has to be photographed by means of the above mentioned cameras all at a time, and the dry plates thus sensitized, however, have to be left undeveloped.

In the second step, an object to be reproduced, for instance, a human body is caused to sit or stand in the initial position of said photographing axis and a duplicate photographing of the object has to be carried out on the same dry plates undeveloped as those employed in the first step by means of the cameras all at a time by projecting the images of the screens on the object during the whole period of the photographing.

In the third step, the negative photographs treated in the first and second steps have to be enlarged or contracted in the required proportions and printed, so that positive pictures can be obtained.

In the fourth step, a vertical sculpturing axis has to be provided corresponding to the vertical photographing axis which was employed in the first and second steps.

Then the same number of magic lanterns as that of cameras initially employed are installed around said vertical sculpturing axis as a central line in such respectively analogous positions that the cameras initially employed during the photographing in the first and second steps were placed around the vertical photographing axis.

That is to say, each magic lantern, in this case, is so arranged as to take the same projecting angle as that photographing one of each corresponding camera, so that the respective positive picture obtained in the third step can be projected on some plastic material, for instance, modelling clay. And this material has to be heaped, or, as the case may require, milled away up to the intersecting lines or points of the projected lines of more than two photographs denoting the definite lines or points on the object in accordance with the stripes or points of the screens that were projected on the object in the second step, thereby enabling a bust or statue to be sculptured, very alike to the object to be reproduced.

For better explaining the invention, reference is made to the accompanying drawings.

Fig. 1 is a diagrammatical plan view illustrating the photographing process which has to be carried out in the first and second steps of the present invention.

Fig. 2 is an assumptive view of the negative photograph obtained in the second step.

Fig. 3 is a negative photograph obtained in the first and second steps.

Fig. 4 is a diagrammatical plan view illustrating the arrangement of magic lanterns for the purpose of projecting the positive picture in the third step, in which the negative photograph produced in the second step has to be tightly stuck or enlarged and printed.

Fig. 5 is a partial view indicating the fourth step.

Fig. 6 is a diagrammatical view illustrating the enlarging or contracting proportions of a taken picture and also indicating the process for determining the distance between the magic lanterns and the plastic material to be sculptured.

Two points, 2, as shown in Fig. 2 are indicated respectively at an upper and a lower position on the vertical photographing axis 1 consisting of a slender line as shown in Fig. 1.

More than three cameras 3 and more than two projectors 4 are installed around said axial line 1, all of them confronting it.

In this case, the shutters of the cameras 3 are so arranged as to be opened or closed all at one time.

The above-mentioned projectors 4 are provided with screens inside, on which many stripes or points are dispersed so that the images of these screens can be illuminated and projected on the object to be reproduced.

By employing a set of said cameras and projectors, the photographing process must be carried out during the first and second steps.

In order to effect the invention, the following four steps have to be carried out in succession.

In the first step:

The electric lamps of the chamber have to be put out so that only the slender line indicating the axis 1 can be illuminated by means of the projectors and photographed by means of the

cameras all at a time, however, leaving the dry plates undeveloped. (Fig. 2 shows a developed one of the photographs.)

Numeral 1 in Fig. 1 is a slender line indicating the photographing axis. Numeral 2 represents two points signalized on the slender line.

In the second step:

The above mentioned slender line 1 must be removed first, and the object 5, for instance, a human body is caused to take the initial place of said line 1, so that the images of the screens are projected on the object by means of the projectors 4 all the time, during which the shutters of the cameras 3 have to be opened all at a time, thus carrying out a duplicate photographing of the object on the same dry plates as those employed in the first step and now developing them.

Fig. 3 shows a negative photograph obtained in the first and second steps.

Numeral 1, in the drawing, represents the photographing axis, 2 two points signalized on the slender line, 5 a photograph of the object, and 6 a picture of the images of the screens.

In the third step:

The picture thus obtained in the second step is enlarged or contracted in the required proportions and printed in accordance with the focal distance of the lenses of the cameras, the size of a bust or statue to be sculptured and the focal distance of the lenses attached to magic lanterns which will be employed in the following fourth step.

If the size of the object 5 is assumed to be A, the size of a bust or statue to be sculptured A', and the focal length of the lenses of the cameras and magic lanterns to be f and f' respectively, the required proportions can be determined by the following equations, as the photographing angle and the projecting one of magic lantern comes to the same degree $\alpha°$, which has been promised according to the invention. (Refer to Fig. 6.)

$$\frac{1}{f}=\frac{1}{a}+\frac{1}{b} \quad (1)$$

$$\frac{1}{f'}=\frac{1}{a'}+\frac{1}{b'} \quad (2)$$

$$\frac{A}{A'}=\frac{a}{a'},=K \text{ (constant)} \quad (3)$$

From the first, second and third equations,

$$\frac{b}{b'}\left(\frac{a-f'K}{a-f}\right)$$

In the fourth step:

There must be now provided a sculpturing axis 7 in a vertical direction, corresponding to the photographing axis consisting of a slender line as employed in the first and second steps.

The same number of magic lanterns 8 as that of cameras already employed in the first and second steps must be installed around said sculpturing axis 7 exactly in such analogous positions that the cameras 3 were around their axial line 1.

And each magic lantern is so arranged as to take the same projecting angle $\alpha°$ as that photographing one ($\alpha°$) of each corresponding cameral already employed, thereby enabling the positive photograph obtained in the third step to be projected on.

Whether the position of each magic lantern 8 to the sculpturing axis 7 is exactly analogous to that of each camera to the photographing axis, as mentioned above, can be judged by examining whether the image of the photographing axis 1 and the projected images of the upper and lower points 2 on the positive photograph which is being projected by each magic lantern 8 have fallen exactly on the sculpturing axis 7, or also by examining whether each neighbouring camera may correspond each angle, for instance, $\beta°$, $\beta_1°$ or $\beta_2°$, as the axis 1 for a common vertex, to each other respectively.

In order to correspond the projecting angle $\alpha°$ of magic lantern to the photographing one $\alpha°$ of camera, the positive photograph enlarged or contracted in the required proportions in the third step will have only to be treated in such a manner that the distance between the sculpturing axis 7 and the optical centre of the lens of a magic lantern is made constant a' by employing said lantern having a constant focal length f' as shown in Fig. 6.

According to the fourth step, a set of magic lanterns, as mentioned above, are employed, and clay or other plastic mass 11 is placed after the sculpturing axis 7 has been removed.

Then two neighbouring magic lanterns 8_1 and 8_2 or other two lanterns 8_1 and 8_3 forming a larger angle, as the axial line 7 for its vertex, may be employed so that the illuminated lines of the positive photographs obtained in the third step can be projected on the plastic mass through said lanterns. And the mass may be heaped or milled away up to the intersecting position 10 of the projected lines or points 9 and 9' corresponding to each other among all of the lines or points which were the illuminated images of the screens on the object, thus sculpturing the whole circumference of the bust or statue.

In the case of projecting the positive pictures at the same time through two magic lanterns, as mentioned above, it is better to use two transparent screens, different from each other in colour, for instance, a red-coloured cellophane is attached to the one magic lantern and a blue-coloured one to the other so that the intersecting point 1 of both projecting lines can be easily found out, thereby facilitating an easy discovery of any errors on the bust or statue to be made during the sculpturing operation.

According to the present invention, more than two of upper and lower signalized points 2 are photographed in the first step, so that the photographs thus taken serve as preparatory means for making the position of magic lantern to the sculpturing axis 7 to be employed in the fourth step analogous to that of camera 3 to the photographing axis initially employed in the first and second steps.

In the second step of photographing the object 5, a duplicate photographing of it is carried out on the same dry plates of the axial line 1 obtained in the first step, and the relative position of both is recorded, and the screens are also projected on the object so that the discovering of the intersecting point 10 of the projected lines of the definite points photographed on the object can be readily facilitated.

In third step, the photographs taken in the first and second steps are enlarged or contracted in the required proportions, which is determined on a definite basis of calculation, thus serving to equalize the photographing and projecting angles later on, and which conditions are indispensable for making the bust to be sculptured in the fourth step quite analogous to the object to be reproduced.

In the fourth step, by utilizing all the condi-

tions which have been prepared in from the first to the third step, firstly, the same number of magic lanterns 8 as that of cameras initially employed are installed around the sculpturing axis 7 in such analogous positions that the cameras were placed around the photographing axis 1 with the signalized points 2 provided thereon.

Secondly, the projecting angle α° through magic lantern is made entirely equal to the photographing one α° in the case of the first and second steps.

Thirdly, it is readily facilitated to discover the intersecting point 10 of the projected lines illuminating the photographs containing the definite points on the object by projecting the photographs of the projected images of the screens with many stripes or points provided thereon, which were employed in the first and second steps, thereby securing the precise degree of analogical property between the object and the bust or statue to be sculptured, and moreover, enabling it to be made readily.

Namely, according to the present invention, all the steps from first to fourth, stand in close relation to one another and the analogous property of the bust or statue to the object has been guaranteed just by carrying out the afore-said four steps one by one in succession.

ISAO MORIOKA.

PUBLISHED JUNE 15, 1943. BY A. P. C.

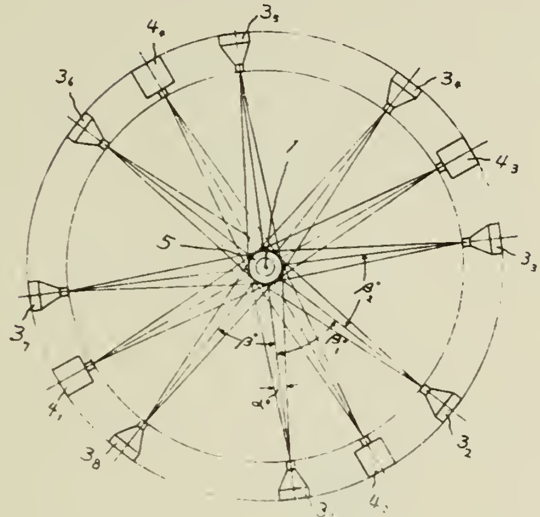
I. MORIOKA

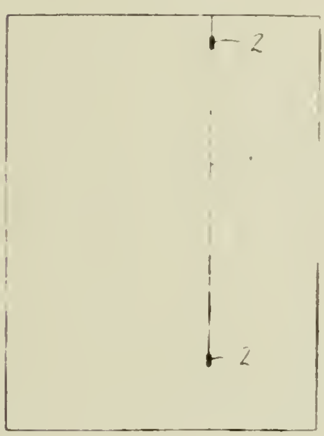
PROCESS FOR PLASTICALLY REPRODUCING OBJECTS

Filed Nov. 20, 1940

Serial No. 366,503

2 Sheets-Sheet 1





Inventor:
Isuo Morioka,
By Cushman, Darby & Cushman
Attorneys.

PUBLISHED

JUNE 15, 1943.

BY A. P. C.

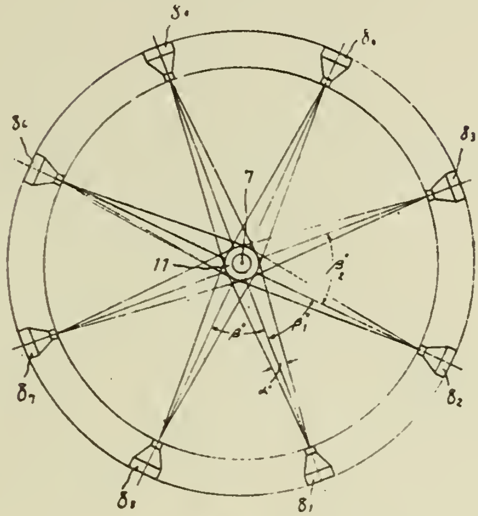
I. MORIOKA

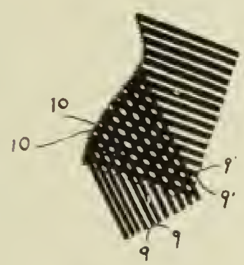
PROCESS FOR PLASTICALLY REPRODUCING OBJECTS

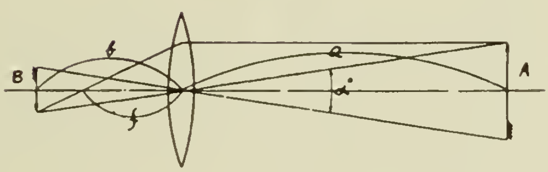
Filed Nov. 20, 1940

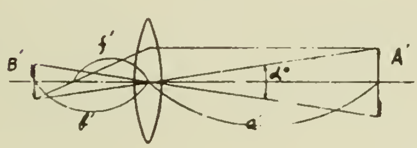
Serial No. 366,503

2 Sheets-Sheet 2









Inventor:

Isao Morioka,

By Cushman, Darby & Cushman

Attorneys.

Published June 15, 1943 Serial No. 367,306

ALIEN PROPERTY CUSTODIAN

APPLYING CHEMICALS TO PLANTS

Kurt Schütz, Leipzig, Germany; vested in the Alien Property Custodian

Application filed November 22, 1940

This invention relates to a method and nozzle for spraying plants with chemicals to exterminate pests and kill weeds.

When destroying pests by wet spraying it is customary to use water as solvent and carrier of the chemicals and to apply under pressure the spraying solution formed through nozzles having small perforations so as to insure fine and uniform distribution.

This method is, however, open to several objections. In order to avoid clogging of the atomizing nozzles the diameter of their perforations cannot be smaller than 1.2 to 2 mm., and the production of a spray having the necessary fineness requires a minimum pressure for the spraying solution of approximately 5 to 6 atmospheres above atmospheric pressure. From these two factors, viz. pressure and sectional area of outlet, follows, in case of field spraying, a consumption of spraying solution per ha. which for most purposes amounts to 800 l. per ha. This average is generally accepted to simplify the proportioning of chemical additions to water. This known method suffers chiefly from the drawback of high consumption of water per ha., in view of the cost of transportation, and also from the defect that a spraying charge of 300 l. covers only 0.375 ha.

It is the object of the invention to propose a new method according to which water while remaining the carrier of the chemicals is used only to the extent of about 100 to 150 l. per ha. The chemicals hitherto in use are employed also, though in correspondingly higher concentration. In further accordance with the invention a foam forming substance of the kind used for instance for fire extinguishing purposes is added to the water mixed with the chemicals. The mixture obtained is then worked in known manner to produce air foam or, in the event of carbon dioxide preparations, chemical foam. The foam is applied to the plants to be protected or exterminated with the aid of compressed air in a finely dispersed condition and uniform manner.

The method according to the invention affords the advantage of reducing the water supply for field work to approximately one-fifth to one-eighth of present requirements, which means that a foam charge of 300 l. will cover about 2–3 ha. instead of 0.375 ha. A further advantage is that larger outlet perforations than for water spraying can be used, since the volume of the final spraying preparation, due to the formation of foam, increases from about 100 to 150 l. per ha. to about 2,000 l per ha., or 13 times. Compared with the accepted standard of 800 l. spraying solution per ha., the volume of foam sprayed according to the invention over the same area is 2½ times as great. Still another feature of the invention resides in effecting a saving, since the spraying of foam requires less power than that of water.

For the practical application of the method according to the invention the nozzles of the type hitherto employed in spraying liquids to exterminate pests are not well suited, because they clog up already at a slight contamination of the spraying solution and thereby interrupt operation.

In the known nozzles the spraying solution passes through a chamber fitted with helical channels so as to have a circulating motion on leaving the nozzle opening. These channels as well as the nozzle opening are quite narrow, which, in addition to the drawbacks mentioned, involves a considerable power requirement for spraying. The advantage of increased output combined with reduced water and power supply afforded by the invention would therefore be lost again if nozzles of the known type were used which clog up so easily and cause many interruptions in operation.

The invention provides therefore a nozzle without narrow cross section, in which also by suitable construction of the parts adjacent the nozzle opening the hitherto required ante-chamber is eliminated. Furthermore, the front side of the air nozzle together with the inner wall of the conduit containing the spraying medium form a gap surrounding the outlet opening like an annular disc and having the effect of allotting an unvarying amount of spraying medium to the outgoing air. Fine impurities can pass the nozzle without trouble, and coarse admixtures remain at the outer edge of the nozzle for the air without causing clogging. The nozzle according to the invention is, moreover, so constructed that it can be taken apart by a simple manipulation and easily cleaned.

One form of the invention is illustrated in the accompanying drawing, in which

Figure 1 is an external view of a nozzle for carrying out the invention;

Fig. 2, a longitudinal section thereof; and

Fig. 3, a cross section thereof.

The air required for spraying the medium flowing through a pipe *a* is guided to the nozzle at slight overpressure through a conduit *b*. The nozzle substantially comprises three parts, viz. the body portion *c* firmly united with the air conduit *b*, the mouthpiece *d* and the casing *e* sur-

rounding parts *c* and *d*. The parts are held together by a hairpinlike member *f* which passes through corresponding bores in the upper portion of the casing *e* and rests in an annular groove on the outside of the body member *c*. The two free ends of the pin *f* are wedge-shaped, as indicated in Fig. 3. Between the body member *c* and the mouthpiece *d* an elastic packing is provided whose thickness is so dimensioned that at the insertion of the pin *f* the parts of the nozzle are elastically forced together under slight pressure. The casing *e* forms part of the piping *a* made up of hose members *h* which connect the various nozzles of the spraying device and are simply pushed over the casing *e*, whereby a watertight connection is established. In the casing *e*, in the extension of the longitudinal axis of the mouthpiece *d*, an outlet opening *i* is formed. Between the front side of the mouthpiece *d* and the inner wall of the casing *e* a gap is provided which surrounds the outlet opening *i* like an annular disc.

Both the air and the spraying medium are fed to the nozzle at very slight overpressure, so that the outlet surface may be made large and hose clips at the joints be dispensed with.

KURT SCHÜTZ.

PUBLISHED
JUNE 15, 1943.
BY A. P. C.

K. SCHÜTZ
APPLYING CHEMICALS TO PLANTS
Filed Nov. 22, 1940

Serial No.
367,306

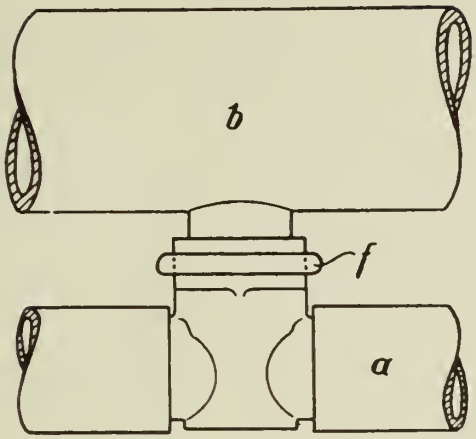


Fig. 1

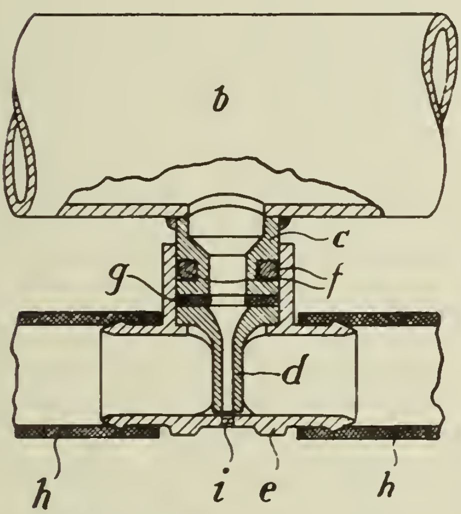


Fig. 2

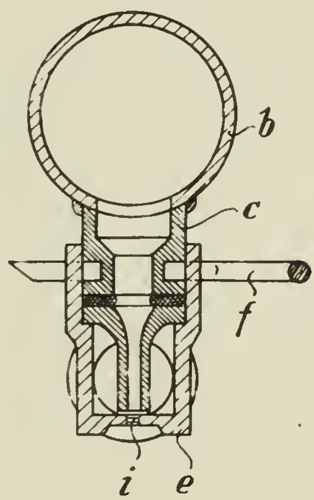
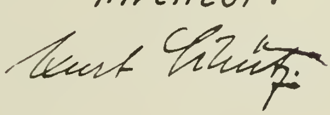


Fig. 3

Inventor:



Published June 15, 1943

Serial No. 369,749

ALIEN PROPERTY CUSTODIAN

MAGNESIUM BASE ALLOYS

Franz Sauerwald, Breslau, Hans Eisenreich and Ludwig Holub, Bitterfeld, Germany; vested in the Alien Property Custodian

No Drawing. Application filed December 12, 1940

This invention relates to magnesium base alloys and is a continuation-in-part of our application Serial No. 236,552, filed October 22, 1938, for Magnesium base alloys.

The development of high percentage magnesium base alloys for castings, was primarily determined by the circumstance that the only possible method of obtaining a cast crystalline structure of technically useful strength properties, from magnesium, was by the incorporation therewith of alloying components having hardening properties. Up to the present, aluminium and zinc have been almost exclusively employed for this purpose. These metals, when employed in the usual proportions of 4 to 10 per cent of aluminium, on occasion together with up to 3 per cent of zinc, exert a hardening and grain-size reducing action on the magnesium, which in itself is soft and solidifies with a coarse radial crystalline structure. According to their special composition and the method of casting (sand, permanent mould, or injection) employed, these known magnesium base casting alloys have, in the as-cast condition, a tensile strength of from 16 to 22 kgs. per sq. mm., with an elongation of 3 to 12 per cent, a yield point of 8 to 16 kgs. per sq. mm. and a notched-bar impact strength of 0.5 mkgs. per sq. cm. ("Werkstoffhandbuch Nichteisenmetalle," 1936, Sheet K_3).

The tendency of these known magnesium base alloys to form so-called "micro-shrinkage" cracks during solidification must, however, be regarded as a defect. These micro-shrinkage cracks not only render the castings permeable, to some extent, to liquids or gases, but also, in certain circumstances, considerably impair, by the "notch" effect which said cracks produce, the good mechanical properties attainable by castings of sound crystalline structure. This tendency is especially marked in highly stressed portions of the castings which have thus to be correspondingly thickened. The tendency of the known casting alloys to form such micro-shrinkage cracks appears to be connected with their relatively high content of alloying components, the addition of which in appreciable amounts causes a widening of the solidification interval, i. e. the temperature range between the points of incipient and completed solidification, respectively, as compared with pure or only slightly alloyed magnesium. Attempts to counteract the formation of these micro-shrinkage cracks have hitherto been confined to the extensive use of chill plates and other measures for rapidly cooling the areas where the structure is endangered. Such measures are, however, expensive and also frequently difficult to control in practice.

Bearing in mind the conditions, viz. fineness of grain and narrow solidification interval, which are the main causes for the formation of cast structures of high strength and free from micro-shrinkage cracks, systematic experiments were conducted for the purpose of finding an alloying component or components which would produce a powerful grain-size reducing effect on magnesium, even when employed in such small proportions as are insufficient to cause any appreciable widening of the solidification interval.

As a result of these experiments it was found that zirconium is a metal which fulfills the foregoing requirements, in that even when alloyed with magnesium in proportions of about 0.05 to 2.0 per cent it reduces the grain-size to a far greater extent than the hitherto customary far greater proportions of aluminium and zinc. Moreover, when adding zirconium to the magnesium in the foregoing proportions, the temperature of incipient solidification of the resulting alloys still practically coincides with the temperature at which the resulting alloys become totally solidified so that such alloys solidify without any appreciable formation of micro-shrinkage cracks. The grain-size reducing action of zirconium on pure magnesium (tensile strength in the as-cast condition 9 to 13 kgs. per sq. mm., elongation 5 to 6 per cent) is so powerful that an addition of 0.5 per cent of zirconium imparts to the resulting alloy a tensile strength of 18.5 kgs. per sq. mm. and a yield point of 7 kgs. per sq. mm., which values are nearly equal to those of the casting alloys hitherto in use. Moreover, the elongation is increased to 21.0 per cent and the notched-bar impact strength to 1.5 mkgs. per sq. cm., these values being thus considerably higher than the corresponding values exhibited by the usual casting alloys.

These values exhibited by the binary magnesium-zirconium alloys can be still further improved by the addition of other alloying components. It has, however, transpired that by no means all the components adapted to alloy with magnesium are suitable for this purpose but that, on the contrary, the presence of various of such alloying components more or less prevents the zirconium from exercising its favourable grain refining effect. Thus it has been found that only such alloying components are permissible as are incapable of combining with the zirconium dissolved in the molten magnesium to form high melting compounds which separate out or otherwise physically combine therewith to form components which settle out. In this respect, for example, the metals cerium, thorium, and calcium are suitable alloying components. Other metals, however, for example, aluminium, silicon, tin, cobalt, nickel, antimony, and manganese, which appear to form with zirconium segregating intermetallic high melting compounds, when present in molten magnesium jointly with zirconium, are unsuitable. Moreover, bearing in mind the main ob-

jective of the invention, the amount of alloying components should preferably be insufficient to cause any appreciable widening of the solidification interval of the binary magnesium-zirconium alloys, since otherwise the advantage of freedom from micro-shrinkage cracks will progressively disappear. Thus, the alloy may contain in addition to magnesium and its 0.05 to 2.0 per cent zirconium component between about 0.05 and about 15 per cent of cerium, or between about 0.05 and about 15 per cent of thorium, or between about 0.05 and about 5 per cent, and preferably not more than about 1.0 per cent of calcium, or up to about 25 per cent of two or all of the aforesaid metals jointly, each within the aforesaid limits.

In addition to magnesium and the aforesaid alloying components, viz. zirconium, cerium, and/or thorium, and/or calcium, the alloys according to the invention may also contain at least one metal of the group consisting of zinc 0.1 to 14 per cent, and cadmium 0.1 to 24 per cent, the total amount of cerium, thorium, calcium, zinc, and cadmium jointly not exceeding about 25 per cent.

Since the corrosion resistance of casting alloys is enhanced by a fine grained and compact crystalline structure, the alloys of the present invention are equal with respect to corrosion resistance and especially with respect to resistance to stress corrosion, to the best of the hitherto known magnesium base alloys, so that the addition of manganese, which has hithereto been considered essential for improving the corrosion resistance but which, in this case, would prevent the zirconium from exercising its beneficial effects, can be dispensed with.

The fine grain which is formed in the solidification of the magnesium-zirconium alloys of the present invention, also persists after repeated remeltings and pourings of the alloys. The formation of the fine grained structure is practically independent of the cooling velocity of the poured alloys, and therefore occurs both in casting in permanent moulds and in sand moulds. It is equally immaterial to the fineness of grain whether the zirconium be introduced into pure magnesium or into a magnesium alloy, provided that the alloying components already present in the magnesium do not form any segregating intermetallic compounds with zirconium. The following aie typical examples of suitable ternary or complex casting alloys in accordance with the invention.

Alloy	Tensile strength	Elongation	Yield point
	Kgs./sq. mm.	*Per cent*	*Kgs./sq. mm.*
Mg with— 1.0% Zr, 1.0% Ce	15.9	8.0	8.0
Mg with— 1.0% Zr, 4.0% Ce	15.5	3.0	11.0
Mg with— 1.0% Zr, 2.0% Th	17.7	14.2	9.0
Mg with— 1.0% Zr, 1.0% Ca	15.8	6.2	9.0
Mg with— 1.0% Zr, 3.3% Ce, 3.5% Th	13.4	1.0	10.8
Mg with— 1.0% Zr, 2.2% Th, 0.5% Ca	17.0	11.0	8.0
Mg with— 1.0% Zr, 1.0% Ce, 6.0% Zn	20.0	4.0	14.0
Mg with— 1.0% Zr, 0.2% Ca, 1.0% Zn	21.9	10.5	10.6
Mg with— 1.0% Zr, 0.7% Ca, 4.0% Zn	22.2	7.8	12.8
Mg with— 1.0% Zr, 0.2% Ca, 6.0% Zn	20.7	4.3	14.1
Mg with— 1.0% Zr, 0.7% Ca, 2.0% Cd	15.8	5.6	9.4
Mg with— 1.0% Zr, 0.2% Ca, 0.2% Ce, 1.0% Zn	21.0	10.8	9.8
Mg with— 1.0% Zr, 0.4% Ca, 0.2% Ce, 1.0% Zn	20.9	18.2	7.4

The desirable properties of the above described alloys, and especially their excellent ductility and notched-bar impact tenacity, render them also suitable for wrought goods. Even a binary alloy containing up to about 2.0 per cent of zirconium exhibits, after extrusion, strength values equal to those of the usual wrought magnesium alloys containing considerable amounts of aluminium and on occasion also zinc, whilst being substantially superior thereto in respect of tenacity. The introduction of further permissible alloying components, such as cerium and/or thorium and/or calcium, increases the strength of the wrought alloys as well, or improves the ratio between tensile strength and elongation. Another important point is that the wrought alloys in particular are often enough distinguished from the known wrought alloys by their suitability for welding.

The mechanical properties obtainable with the known wrought magnesium alloys are approximately as follows:

Tensile strength	kgs. per sq. mm.	28 to 37
Yield point	do	20 to 28
Elongation	per cent	7 to 16

(See "Werkstoffhandbuch Nichteisenmetalle," 1936, Sheet K_4, alloys AZM, AZ 855, VI). By comparison, typical wrought alloys of the present invention give the following values:

Alloy	Tensile strength	Elongation	Yield point
	Kgs./sq. mm.	*Per cent*	*Kgs./sq. mm.*
Mg with— 1.0% Zr, 0.2% Ce	45.5	3.3	41.6
Mg with— 1.0% Zr, 2.0% Th	42.5	3.0	40.0
Mg with— 1.0% Zr, 0.5% Ca	23.1	23.3	17.4
Mg with— 1.0% Zr, 0.2% Ca, 1.0% Zn	29.8	18.2	27.6
Mg with— 1.0% Zr, 0.2% Ca, 0.2% Ce, 1.0% Zn	35.5	7.4	33.8
Mg with— 1.0 Zr, 0.7% Th, 3.0% Zn, 2.0% Cd	43.5	3.0	40.0

FRANZ SAUERWALD.
HANS EISENREICH.
LUDWIG HOLUB.

Published June 15, 1943

Serial No. 369,721

ALIEN PROPERTY CUSTODIAN

CARBURETORS FOR INTERNAL COMBUSTION ENGINES

Fritz Fiedler, Munich, Germany; vested in the Alien Property Custodian

Application filed December 12, 1940

The carburetors of internal combustion engines are exposed, as is known, during operation to the influence of the heat rays radiated by the cylinder wall and specially by the exhaust pipes. The effect of these heat rays can be such as to cause already during normal operation the boiling of the carburetor and thus an insufficient supply of combustible mixture to the combustion chambers will be the consequence.

To prevent particularly the float chamber from being excessively heated, it has been already proposed to place the intake pipe round the float chamber of the carburetor so that it can be passed over by the cool fresh air current. This form of embodiment easily may have the consequence of supercooling the float chamber which has an unfavourable effect on the supply of combustible mixture.

In order to protect the carburetor as well against warm influences as against cold ones, the carburetor together with its intake passage is, according to the invention, covered in all round by a cage. Into this cage a tube uniting a fresh air tube and warm air tube is leading. The fresh air tube takes in the cold air at any place remote from the engine, the warm air tube the air in proximity of the exhaust pipe. Both tubes are provided with a throttle each which are connected with each other in a certain way by a lever mechanism. The adjustment of the two throttles is effected either manually or automatically by a bimetallic spiral, a thermostat or the like which cause that only such a quantity of fresh air or warm air is permitted to enter the guarding cage as is necessary to obtain the desired temperature around the carburetor. In the upper part of the guarding cage there is arranged a filter through which the air is lead for cleaning to the upper part of the carburetor and from there to the intake passage of the carburetor. The cage is preferably provided with a removable cover.

The use of a cage brings about at the same time a further advantage, i. e. it is acting as intake silencer particularly in the case when the cage, according to the invention, is made of or lined with a silencing material.

The drawing shows one form of embodiment of the invention.

The carburetor 1 has the usual form. The fresh air is taken in through a passage 2 and the combustible mixture is lead through the conduit 3 into the combustion chamber of the internal combustion engine. The carburetor 1 is, according to the invention, completely surrounded by a cage 4 serving to screen or guard the carburetor. This cage 4 is provided at one side with a tube 5, into which two branch tubes 6 and 7 are discharging. Through the branch tube 6 fresh air which is caught in some way or other from outside, is lead to the tube 5 and from there to the cage 4. The warm air for the tube 7 is likewise taken in from outside but at a place which is heated by the exhaust gases.

In each of the tubes 6 and 7 a throttle 8, resp. 9 is provided which through a lever mechanism 10 are in positive connection with each other. The throttles 8, 9 are controlled manually or automatically by means of a bimetallic spiral, a thermostat 11 or the like, adjusting the throttles 8 and 9 in response to the air temperature surrounding the carburetor, so that either more warm air can flow through the tube 7 into the cage 4 or more cold air through the tube 6.

The upper part of the cage 4 contains a filter 12. Into the space above the filter is projecting the intake passage 2 for the carburetor, so that the air for the carburetor is taken from this space after previously being cleaned through the filter 12.

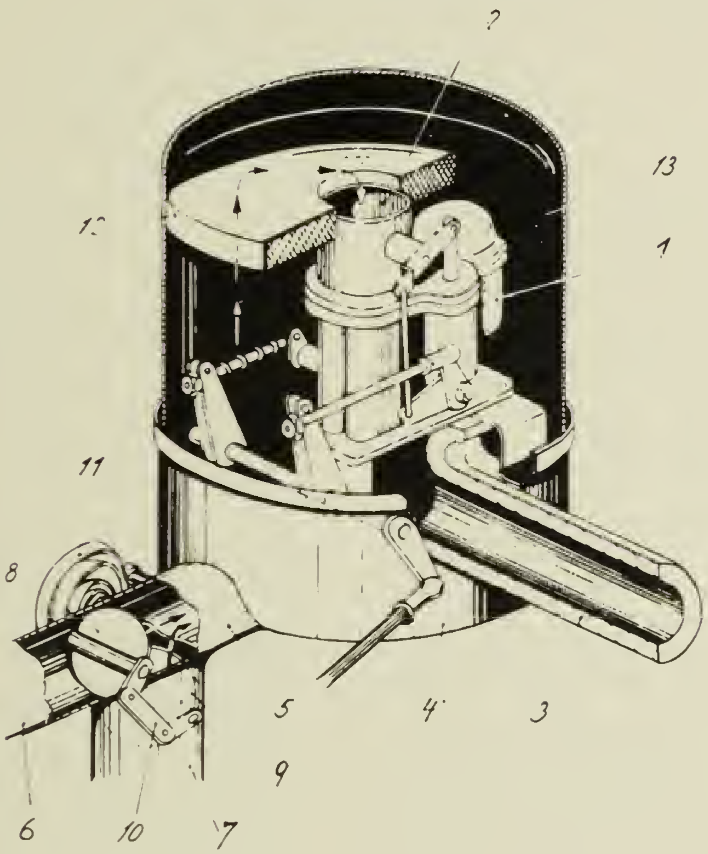
The cage 4 is preferably executed with a detachable cover 13 to have the possibility of cleaning or replacing the filter after a certain time.

As already stated the automatic adjustment can be effected by a bimetallic spiral, a thermostat or a similar organ responding to variations in temperature. This organ is preferably arranged at a protected place not exposed to the fresh air or even in the guarding cage 4 itself.

The manner of action of the new carburetor is characterized by the fact that as long as under the guarding cage or resp. under the cowling of a motor vehicle a normal temperature is prevailing, the fresh air tube remains closed. The engine is charged in this case with air preheated by the warm air tube. With increasing temperature below the cowling resp. the guarding cage, the warm air tube is gradually closed by the thermo-element and the fresh air tube opened and inversely.

FRITZ FIEDLER.

PUBLISHED | F. FIEDLER | Serial No.
JUNE 15, 1943. | CARBURETORS FOR INTERNAL COMBUSTION ENGINES | 369,721
BY A. P. C. | Filed Dec. 12, 1940



INVENTOR
Fritz Fiedler
BY A. A. Dicke
Connolly & Hutz
ATTORNEYS

Published June 15, 1943

Serial No. 369,824

ALIEN PROPERTY CUSTODIAN

MAGNESIUM BASE ALLOYS

Franz Sauerwald, Breslau, and Hans Eisenreich and Ludwig Holub, Bitterfeld, Germany; vested in the Alien Property Custodian

No Drawing. Application filed December 12, 1940

This invention relates to magnesium base alloys and is a continuation-in-part of our application Serial No. 236,552, filed October 22, 1938, for Magnesium Base Alloys.

The development of high percentage magnesium base alloys for castings, was primarily determined by the circumstance that the only possible method of obtaining a cast crystalline structure of technically useful strength properties, from magnesium, was by the incorporation therewith of alloying components having hardening properties. Up to the present, aluminium and zinc have been almost exclusively employed for this purpose. These metals, when employed in the usual proportions of 4 to 10 percent of aluminium, on occasion together with up to 3 per cent of zinc, exert a hardening and grain-size reducing action on the magnesium, which in itself is soft and solidifies with a coarse radial crystalline structure. According to their special composition and the method of casting (sand, permanent mould, or injection) employed, these known magnesium base casting alloys have, in the as-cast condition, a tensile strength of from 16 to 22 kgs. per sq. mm., with an elongation of 3 to 12 per cent, a yield point of 8 to 16 kgs. per sq. mm. and a notched-bar impact strength of 0.5 mkgs. per sq. cm. ("Werkstoffhandbuch Nichteisenmetalle," 1936, Sheet K_3.)

The tendency of these known magnesium base alloys to form so-called "micro-shrinkage" cracks during solidification must, however, be regarded as a defect. These micro-shrinkage cracks not only render the castings permeable, to some extent, to liquids or gases, but also, in certain circumstances, considerably impair, by the "notch" effect which said cracks produce, the good mechanical properties attainable by castings of sound crystalline structure. This tendency is especially marked in highly stressed portions of the castings which have thus to be correspondingly thickened. The tendency of the known casting alloys to form such micro-shrinkage cracks appears to be connected with their relatively high content of alloying components, the addition of which in appreciable amounts causes a widening of the solidification interval, i. e. the temperature range between the points of incipient and completed solidification, respectively, as compared with pure or only slightly alloyed magnesium. Attempts to counteract the formation of these micro-shrinkage cracks have hitherto been confined to the extensive use of chill plates and other measures for rapidly cooling the areas where the structure is endangered. Such measures are, however, expensive and also frequently difficult to control in practice.

Bearing in mind the conditions, viz. fineness of grain and narrow solidification interval, which are the main causes for the formation of cast structures of high strength and free from micro-shrinkage cracks, systematic experiments were conducted for the purpose of finding an alloying component or components which would produce a powerful grain-size reducing effect on magnesium, even when employed in such small proportions as are insufficient to cause any appreciable widening of the solidification interval.

As a result of these experiments it was found that zirconium is a metal which fulfills the foregoing requirements, in that even when alloyed with magnesium in proportions of about 0.05 to 2.0 per cent it reduces the grain-size to a far greater extent than the hitherto customary far greater proportions of aluminium and zinc. Moreover, when adding zirconium to the magnesium in the foregoing proportions, the temperature of incipient solidification of the resulting alloys still practically coincides with the temperature at which the resulting alloys become totally solidified so that such alloys solidify without any appreciable formation of micro-shrinkage cracks. The grain-size reducing action of zirconium on pure magnesium (tensile strength in the as-cast condition 9 to 13 kgs. per sq. mm., elongation 5 to 6 per cent) is so powerful that an addition of 0.5 per cent of zirconium imparts to the resulting alloy a tensile strength of 18.5 kgs. per sq. mm. and a yield point of 7 kgs. per sq. mm., which values are nearly equal to those of the casting alloys hitherto in use. Moreover, the elongation is increased to 21.0 per cent and the notched-bar impact strength to 1.5 mkgs. per sq. cm., these values being thus considerably higher than the corresponding values exhibited by the usual casting alloys.

These values exhibited by the binary magnesium-zirconium alloys can be still further improved by the addition of other alloying components. It has, however, transpired that by no means all the components adapted to alloy with magnesium are suitable for this purpose but that, on the contrary, the presence of various of such alloying components more or less prevents the zirconium from exercising its favourable grain refining effect. Thus it has been found that only such alloying components are permissible as are incapable of combining with the zirconium dissolved in the molten magnesium to form high

melting compounds which separate out or otherwise physically combine therewith to form components which settle out. In this respect, for example, the metals silver, copper, cerium, thorium, and calcium are suitable alloying components, and we have found that very useful alloys may be obtained by adding to magnesium and its 0.05 to 2.0 per cent zirconium component at least one metal of the group consisting of silver and copper, and at least one metal of the group consisting of cerium, thorium, and calcium. Other metals, however, for example, aluminium, silicon, tin, cobalt, nickel, antimony, and manganese, which appear to form with zirconium segregating intermetallic high melting compounds, when present in molten magnesium jointly with zirconium, are unsuitable. Moreover, bearing in mind the main objective of the invention, the amount of alloying components should preferably be insufficient to cause any appreciable widening of the solidification interval of the binary magnesium-zirconium alloys, since otherwise the advantage of freedom from micro-shrinkage cracks will progressively disappear. Thus the alloys may contain in addition to its 0.05 to 2.0 per cent zirconium component, at least one metal of the group consisting of copper 0.05 to 6 per cent, preferably not more than about 0.3 per cent, and silver 0.1 to 15 per cent, preferably not more than about 3.0 per cent, and at least one metal of the group consisting of cerium 0.05 to 15 per cent, thorium 0.05 to 15 per cent, and calcium 0.05 to 5 per cent, preferably not more than about 1.0 per cent, or up to about 30 per cent of two or more of the five last-named metals jointly, each within the aforesaid limits.

In addition to magnesium and the aforesaid alloying components, viz. zirconium and copper and/or silver, and cerium and/or thorium and/or calcium, the alloys according to the invention may also contain at least one metal of the group consisting of zinc 0.01 to 14 per cent and cadmium 0.01 to 24 per cent, the total amount of copper, silver, cerium, thorium, calcium, zinc, and cadmium jointly not exceeding 30 per cent.

Since the corrosion resistance of casting alloys is enhanced by a fine grained and compact crystalline structure, the alloys of the present invention are equal with respect to corrosion resistance and especially with respect to resistance to stress corrosion, to the hitherto known corresponding magnesium base alloys free from zirconium, so that the addition of manganese, which has hitherto been considered essential for improving the corrosion resistance but which, in this case, would prevent the zirconium from exercising its beneficial effects, can be dispensed with.

The fine grain which is formed in the solidification of the magnesium-zirconium alloys of the present invention, also persists after repeated remeltings and pourings of the alloys. The formation of the fine grained structure is practically independent of the cooling velocity of the poured alloys, and therefore occurs both in casting in permanent moulds and in sand moulds. It is equally immaterial to the fineness of grain whether the zirconium be introduced into pure magnesium or into a magnesium alloy, provided that the alloying components already present in the magnesium do not form any segregating intermetallic compounds with zirconium. The following are typical examples of suitable quaternary or complex casting alloys in accordance with the invention.

Alloy	Tensile strength	Elongation	Yield point
	Kgs./sq. mm.	*Per cent*	*Kgs./sq. mm.*
Mg with— 1.0% Zr 2.4% Ag 1.5% Th	14.9	6.8	7.1
Mg with— 1.0% Zr 3.0% Ag 0.2% Ca	21.0	12.0	8.9
Mg with— 1.0% Zr 0.3% Cu 1.0% Th	17.8	9.6	6.8
Mg with— 1.0% Zr 0.2% Cu 0.3% Ca	18.3	12.9	8.3
Mg with— 1.0% Zr 0.3% Cu 3.0% Ag 0.7% Ca	17.1	4.1	11.8
Mg with— 1.0% Zr 0.3% Cu 0.5% Ce 0.2% Ca	18.5	12.4	8.6
Mg with— 1.0% Zr 0.3% Cu 1.0% Th 0.2% Ca	14.1	4.9	7.4
Mg with— 1.0% Zr 0.1% Cu 0.3% Ca 0.6% Zn	17.3	5.0	11.3
Mg with— 1.0% Zr 0.3% Cu 0.3% Ca 0.6% Zn	19.8	10.0	10.1
Mg with— 1.0% Zr 0.3% Cu 0.3% Ca 3.0% Zn	17.3	4.1	10.7
Mg with— 1.0% Zr 2.4% Ag 0.5% Ce 1.5% Th 2.0% Zn	17.9	7.1	8.6
Mg with— 1.0% Zr 2.4% Ag 0.5% Ce 1.5% Th 2.0% Cd	17.3	7.8	7.8

The desirable properties of the above described alloys, and especially their excellent ductility and notched-bar impact tenacity, render them also suitable for wrought goods. Even a binary alloy containing up to about 2.0 per cent of zirconium exhibits, after extrusion, strength values equal to those of the usual wrought magnesium alloys containing considerable amounts of aluminium and on occasion also zinc, whilst being substantially superior thereto in respect of tenacity. The introduction of further permissible alloying components, such as at least one metal of the group consisting of copper and silver and at least one metal of the group consisting of cerium, thorium, calcium, increases the strength of the wrought alloys as well, or improves the ratio between tensile strength and elongation. Another important point is that the wrought alloys in particular are often enough distinguished from the known wrought alloys by their suitability for welding.

The mechanical properties obtainable with the known wrought magnesium alloys are approximately as follows:

Tensile strength 28 to 37 kgs. per sq.mm.; Yield point 20 to 28 kgs. per sq.mm.; elongation 7 to 16 per cent (See "Werkstoffhandbuch Nichteisenmetalle", 1936 Sheet K4, alloys AZM, AZ 855, VI).

By comparison, typical wrought alloys of the present invention give the following values:

Alloy	Tensile strength	Elongation	Yield point
	Kgs./sq. mm.	*Per cent*	*Kgs./sq. mm.*
Mg with— 1.0% Zr, 3.0% Ag, 0.2% Ca	31.6	13.5	28.6
Mg with— 1.0% Zr, 0.3% Cu, 1.0% Th	29.6	12.0	28.5
Mg with— 1.0% Zr, 0.3% Cu, 0.7% Ca	27.9	12.8	26.1
Mg with— 1.0% Zr, 0.3% Cu, 3.0% Ag, 0.7% Ca	30.8	12.9	27.3
Mg with— 1.0% Zr, 0.3% Cu, 0.5% Ce, 0.2% Ca	41.6	3.8	38.8
Mg with— 1.0% Zr, 0.3% Cu, 1.0% Th, 0.2% Ca	30.9	9.5	30.9
Mg with— 1.0% Zr, 2.4% Ag, 0.5% Ce, 1.5% Th, 2.0% Zn	41.4	5.0	36.8
Mg with— 1.0% Zr, 2.4% Ag, 0.5% Ce, 1.5% Th, 2.0% Cd	39.2	7.0	35.8
Mg with— 1.0% Zr, 0.3% Cu, 0.3% Ca, 0.6% Zn	34.9	6.5	32.9
Mg with— 1.0% Zr, 0.3% Cu, 0.3% Ca, 3.0% Zn	41.1	5.9	38.8
Mg with— 1.0% Zr, 0.3% Cu, 0.7% Ca, 3.0% Zn	33.6	11.1	32.7
Mg with— 1.0% Zr, 0.3% Cu, 3.0% Ag, 0.7% Ca, 3.0% Zn	35.8	8.9	31.7

FRANZ SAUERWALD.
HANS EISENREICH.
LUDWIG HOLUB.

Published June 15, 1943

Serial No. 373,690

ALIEN PROPERTY CUSTODIAN

HYDRATION OF OLEFINES

Henri Martin Guinot, Niort, France; vested in the Alien Property Custodian

Application filed January 8, 1941

This invention relates to the hydration of olefines to form alcohols.

It is known that olefines may be hydrated to form alcohols by dissolving them in aqueous hydrating liquors from which the alcohol formed is removed by blowing through said liquors a stream of inert gas, or preferably of the actual olefine which is to be reacted.

It is also known that it is frequently desirable to operate under pressure with some olefines, the hydration of which is frequently sluggish at atmospheric pressure because it is necessary to use hydrating baths relatively rich in water in order to effect the rapid saponification of the alcohol-acid derivative transiently formed. However, the known processes are not wholly efficacious when they are made use of under pressure. As a matter of fact, such a pressure increases materially the solubility of the alcohol formed in the hydrating liquor and at the same time decreases its volatility so that at a given temperature, the difficulty of removing the alcohol from the hydrating bath increases with the pressure. Now, it is imperative that the alcohol should be removed from the hydrating bath as soon as possible since its prolonged contact, at an elevated temperature of reaction, with the hydrating liquor not only slows down the reaction, but gives rise to accessory reactions which quickly decrease the yield.

In my prior French application, filed September 14, 1939, for "Process of hydration of olefines," I have described a process which enables to avoid the disadvantages of working under pressure while retaining the advantages of such an operation. According to said process, the hydration of olefines is effected in two separate inter communicating tanks, in one of which solution and hydration of the olefine in the hydrating bath take place at elevated pressure, and in the other of which removal of the alcohol from said bath is effected at substantially atmospheric pressure. The circulation of the hot hydrating bath from the low pressure tank to the high pressure tank is obtained by means of a suitable apparatus, namely an injector operating with the olefine to be treated which has previously been raised to a convenient pressure; the hydrating bath is then returned to the low pressure tank simply by overflowing and passage through a suitable relief valve.

Now I have found that in the above described process the use of an injector is objectionable in some respect. I have particularly found that with such a device the injection of a considerable amount of gas promotes only the entering of a low amount of hydrating bath in the high pressure tank, which results in an important consumption of power. It is also necessary to provide the high pressure tank with a stirring device of a special type allowing the gas forming the atmosphere in said tank to be finely dispersed in the hydrating bath.

An object of the present invention is to improve the above described process and apparatus by improving the circulation of the hydrating bath between the elimination tank and the hydrating tank.

An other object of this invention is to improve the manner in which olefines are brought into intimate contact with the hydrating bath, and consequently to simplify the previously known apparatus.

I have found that, to effect the circulation of the hydrating bath between the two operating tanks, it is particularly advantageous to make use of the emulsifying pump known under the commercial denomination of "Mammoth" pump provided that this is operated with the actual olefine to be treated. Said device ensures a progressive release of the driving olefine and consequently an excellent yield as compared with the injector.

Moreover, owing to the intimate contact obtained between the driving olefine and the hydrating bath, a considerable dissolution effect is obtained in the pump without any supplemental consumption of energy; this results in the hydrating bath leaving said pump being already charged with an important amount of olefine, and that proportionally decreases the work to be done by the tank under pressure, the size of which may be consequently reduced.

When an olefine is treated, such as propylene, the dissolution of which is very easy to perform, it happens sometimes that the hydrating bath is wholly saturated with the olefine when leaving the pump. In such a case, said bath may be directly forwarded, after being released, into the distillation tank, and the tank working under pressure, which is not empolyed, may be omitted.

Other objects and advantages of the present invention will result of the following description of some specific embodiments thereof.

The following examples, taken together with the accompanying diagrammatic drawings will make it clear how the invention may be carried into practice.

In these drawings:

Fig. 1 shows the arrangement of the apparatus according to my invention.

Fig. 2 shows a variante of the arrangement according to Fig. 1.

The apparatus shown by Fig. 1 is employed in the most favourable case in which the hydrating bath is saturated with the olefine when leaving the pump. In case of the saturation being insufficient, use is made of the arrangement shown by Fig. 2 in which the saturation is achieved in a tank working under pressure.

Referring to Fig. 1, the tank B, which works under the atmospheric or a closely related pressure, is fitted with an heating coil **2**, which may be eventually employed for cooling, and with a stirring device **4** of a special type allowing the gas constituting the atmosphere in the tank to be finely emulsified in the hydrating bath. The tank B is further over-topped by a washer-condenser **15** constituted by a tower containing filling materials sprayed with cold pulverized water coming from collars **16** and **16'**. The top of this tower communicates through the pipe **17** with the intake of a fan **18** which forces back with a great speed the gas into the liquid of the tank B through the pipe **19**.

Owing to this speedy circulation of olefine between the tank B and the washer-condenser **15**, the alcohol dissolved in the hydrating bath is continuously carried away as vapours by the flow of olefine; said vapours which penetrate into the washer-condenser through the pipe **20** are dissolved in the washing water. The aqueous alcohol solution so obtained leaves the tower **15** through the pipe **21** and is introduced in the middle part of a small column **22** at the top of which the alcohol is collected at **23**, whereas at the base, pure water flows at **24**.

The injecting device is embodied by an emulsifying pump of the "Mammoth" type which is constituted by a series of emulsifiers E_1, E_2 . . . E_4 connected with gas removing chambers D_1, D_2 . . . D_4. Said pump is fed at one end by the compressed olefinic gas, and at the other end by the hydrating liquid issuing out of the distillation tank and the pressure of which must be raised. The operation of this device is as follows:

Gas cycle.—The compressed olefine issuing from the vessel **9** is introduced into the emulsifier E_4 in which it encounts the liquid coming from D_3, of which the olefine promotes carrying up to D_4 by the pipe r_4.

The gas, partially released, leaves the gas removing chamber through the pipe **41**, and is introduced in the emulsifier E_3 promoting the carrying up of the liquid issuing from D_2; the gas consequently undergoes a further decompression, and so on until it reaches D_1 from which the olefine, which is substantially released, is sent through the pipe **30** in the gazometer **13** after having passed through the separator **29**. Said gas is taken at **25** by the intake of the compressor **26** by which it is raised to the required pressure prior to be sent in the vessel **9**.

Liquid cycle.—After being cooled at **5'**, the hydrating liquid freed from alcohol issuing from the tank B, enters through the pipe **5**, under substantially atmospheric pressure, into the emulsifier E_1 from where it is carried up through r_1 under the action of the partially released olefine coming from D_2 through the pipe **43**. In the course of this going up, the hydrating liquor dissolves a certain amount of olefine and its pressure is increased. At D_1 the hydrating bath is separated from the emulsified gas and then flows away through **31** in the emulsifier E_2 where it encounts the relatively highly compressed olefine coming from D_3 through the pipe **42**. The hydrating liquor is so carried up to D^2, and is simultaneously charged by a supplemental amount of olefine and submitted to a new compression. After a series of similar successive operations effected by means of a more and more compressed gas, the hydrating liquid separated in the last gas removing chamber has reached the required pressure and is saturated by the olefine. Said liquid leaves the pump through the pipe **34**, passes through the pressure reducer **8** and enters through the pipe **6** into the tank B where it is freed from alcohol by means of a heavy stream of blowed olefine issuing from the gazometer **13** through the pipe **14**, as above described.

To sum up, whereas in the Mammoth pump the gas is progressively released in the different elements, on the contrary the hydrating liquor is more and more compressed and simultaneously charged with olefine.

The number of the elements which constitute the pump and the heights to which the liquid is carried up are determined in terms of the nature of the treated olefine.

If so desired, the pipes of the pump through which the liquid is carried up may be lined in order to control the temperature and to maintain it at the correct value.

Example 1.—Manufacture of isopropanol

The tank B is charged with 1000 kg of sulphuric acid at 60% heated to 98° C by the worm **2**. The operative characteristics are as follows:

Number of elements of the pump: 8.

Amount and pressure of the propylene introduced in the pump: 400 kg/hour at a pressure of 7 kg and a temperature of 20° C.

Amount of hydrating liquid introduced in the pump: 550 kg/hour.

Amount of propylene absorbed by the hydrating liquid in the pump: 53,3 kg/hour.

Pressure of the hydraulic liquor at the exit of the pump: 5,6 kg.

With the conditions above defined, the production of the apparatus is 3000 kg of isopropanol each day. In this amount, 1000 kg are obtained in the tank B which, apart its primary function of eliminating the formed alcohol, allows for a supplementary production of alcohol by dissolution and hydration of the olefine blown through said tank.

When the dissolution of the olefine is slow, which for example is the case with ethylene, it is necessary to achieve saturating with olefine the hydrating solution which leaves the pump. In such a case, the device shown by Fig. 2 may be employed, the solution, in lieu of being directly sent to the distillation tank B, is first forwarded to the tank A by pipe **34**. Said tank A provided with an heating coil **1** and with a stirring device **3**, is fed, through the pipe **35**, with olefine contained in the vessel **9**. A regulator of any convenient type, comprising a pressure sensitive element **37**, controlling the inlet valve **38**, allows for the regulation of the pressure in the tank A at such a value that the liquid flows without difficulties from D_4 to A through the pipe **34**. The olefine which is not absorbed in the tank A is directly sent through the pressure reducer **39** and the pipe **40** to the tank B where it promotes the elimination of alcohol. The hydrating solution,

charged to a maximum with olefine in the tank A, is released at 8 and sent through the pipe 6 into the distillation tank B.

Use may be made of pure olefines or of olefines in admixture with inert gases such as saturated hydrocarbons. In the later case, it is necessary, continuously or not, to effect a blow-off by the pipe 27 inserted in the discharge of the fan 18.

In all the cases, the yields remain highly satisfactory. However, if mixture of olefines and inert gases are treated, the reaction rate is reduced, being proportional to the partial pressure of the olefine in the atmosphere of each of the two tanks.

HENRI MARTIN GUINOT.

PUBLISHED

JUNE 15, 1943.

BY A. P. C.

H. M. GUINOT

HYDRATION OF OLEFINES

Filed Jan. 8, 1941

Serial No. 373,690

2 Sheets-Sheet 1

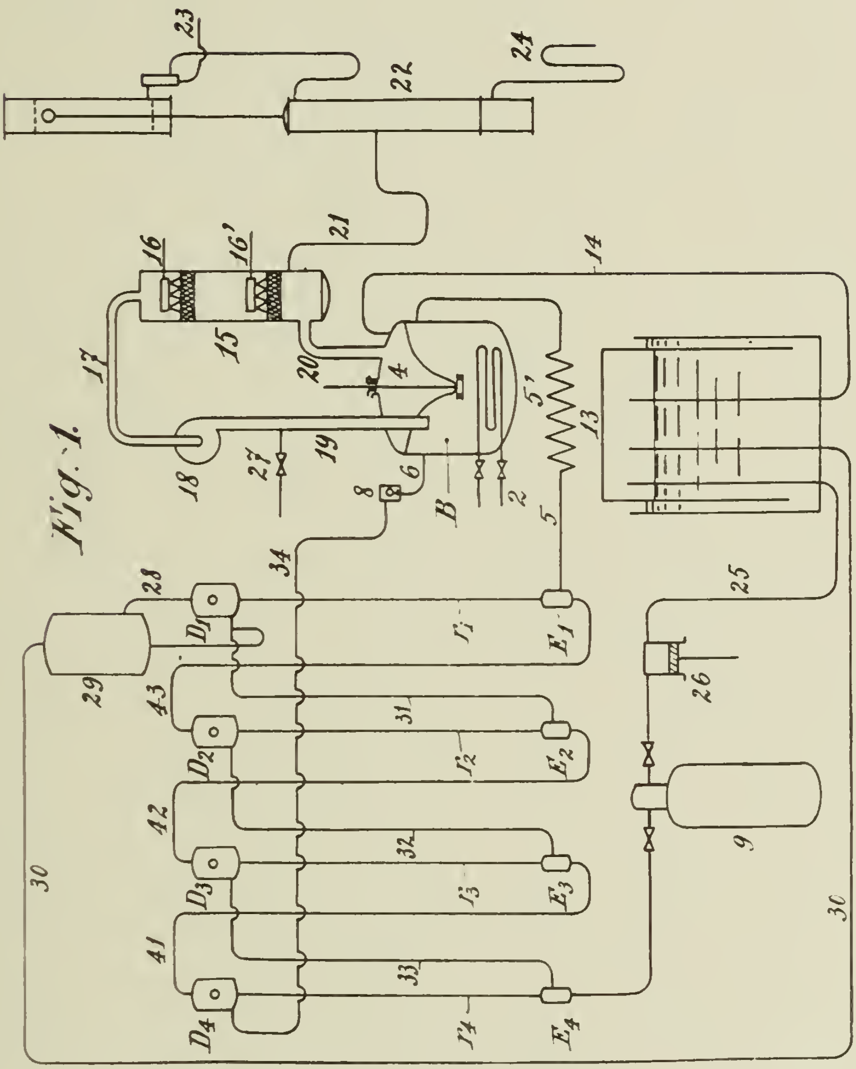


Fig. 1.

Inventor:-
H.M.Guinot
By: Stevens & Davis
Attys.

PUBLISHED
JUNE 15, 1943.
BY A. P. C.

H. M. GUINOT
HYDRATION OF OLEFINES
Filed Jan. 8, 1941

Serial No.
373,690
2 Sheets-Sheet 2

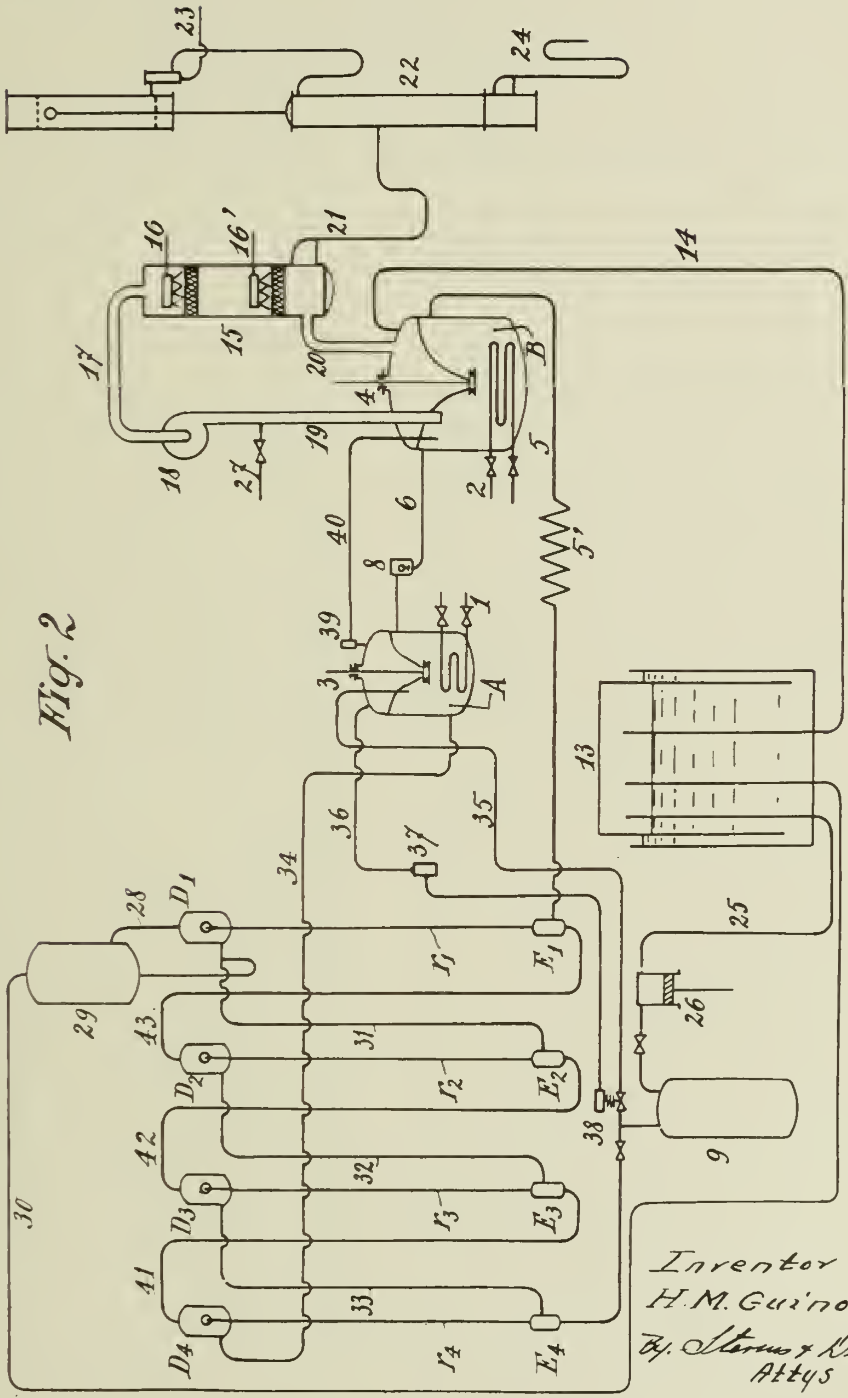


Fig. 2

Inventor
H. M. Guinot
By Stevens & Davis
Attys

Published June 15, 1943 Serial No. 373,705

ALIEN PROPERTY CUSTODIAN

ASSEMBLY OF DEVICES PERMITTING A RATIONAL TRANSMISSION OF MECHANICAL POWER, PARTICULARLY FITTED FOR MOTOR-CARS

Baptistin Branda, Marseille, France; vested in the Alien Property Custodian

Application filed January 8, 1941

The object of the present invention has been the realisation of an assembly of devices destined to substitute, on the one hand, the change gear box, and on the other hand, the clutch on motor-cars; and generally, all similar adjustments mounted on other machines using power at a variable speed.

This assembly fulfills the following conditions:

1°—Realisation of necessities for a rational transmission of power by only actuating the gas admission valve thus permitting:

(*a*) Powerful startings or strong accelerations by the eventual production at the given time and to the maximum of the mean couple, without any risk of stopping the motor.

(*b*) The possibility to maintain the gears on direct drive within very large limits.

(*c*) The realisation of a regimen on an automatic high gear ratio with a very great variety of speeds, permitting thus a constant equilibrium between the power furnished by the motor and the useful work realised. This regimen, possesses a certain value below the corresponding lower speed of the car, being self established, or obtained at will by modifying quickly enough the speed of the engine within the proper limits, which will be specified later, and which will fulfill all the various needs.

(*d*) The possibility for the driver, when the regimen on an automatic high gear ratio is established, to accelerate more or less the motor, without any risk of getting an excessive acceleration, as the thing may possibly occur actually if the gear ratio chosen is a bad one. During this regimen and when the motor gives its whole efficiency, the speed of this latter changes but within limits which are practically very small, determined at the building, and this whatever the degrees of rising of the upward slope on which riding. These extreme limits are determined by the various speeds giving, when fully loaded, on the one hand, the minimum of consumption of fuel by H. P. hour, and on the other hand, the maximum of efficiency of the motor.

(*e*) The automatic re-establishing of the direct drive as soon as this latter becomes possible.

2°—Appreciable economy of fuel when on high gear ratio regimen.

3°—Mechanical efficiency, reliability, weight, volume and price of construction of the new assembly for the least comparable to the same elements of the actual solutions.

4°—Suppression of the clutch, when this latter is actually indispensable for the various changing of speed or to get the motor running while the vehicle is stopped.

In order to facilitate the reading of the following exposition, the drawings hereunto annexed, are given to show, on one hand, the principles of the arrangements constituting the basis of the invention, and on the other hand, to illustrate two industrial realisations.

Figures 1 and 2 show respectively: the one a longitudinal section, and the other a cross section through **41—41** of Figure 1, of a diagrammatic assembly enabling one to see more clearly the principles of the devices.

Figure 3, 4 and 5 are diagrammatic schemes of the dynamic connections so as to better understant the following exposition.

In Figures 6, 7 and 8 are graphs showing the possibilities of the devices comprised in the assembly.

Figures 9, 10, 11 and 12 represent successively: the two parts of a longitudinal section, splitted through **42—42**, of the first industrial realisation; two cross sections through **43—43** and **44—44** of Figure 9, the second one being drawn on a greater scale; and a double view of the plate springs used in this case.

Figures 13, 14, 15 and 16 represent respectively: the two parts of a longitudinal section, splitted through MM, of a second industrial realisation; and three cross sections through **46—46**, **47—47** and **48—48** of Figure 13, the two last ones being partially drawn and on a greater scale.

These two examples of industrial realisations are given without any limitation in the shapes, neither in arrangements of parts, nor in dimensions and nature of the metal used.

Principles of the devices of assembly (plates 1—2—3)

Three independent shafts **1**, **2**, and **3** (Figures 1 and 2) are placed on the same axis. The driving shaft **1** turns in the direction of the arrow *f*; shaft **2** which constitutes an intermediate one; and shaft **3** is connected with the apparatus using the power of the engine.

Shafts **1** and **2** are linked by the dynamic connecting device A which permits all angular movements of these shafts but gives to shaft **2** rotary couples which will be examined further.

Shaft **2** is provided with the device B constituted by a stationary collar bracket **9**, judiciously established so as to permit rotating of this shaft only in the direction shown by the arrow *f*.

Shafts **2** and **3** are connected by the driving device C which allows shaft **2** to transmit a rotation of the shaft **3** in the unic direction of the arrow *f*, but only in the case where the speed of shaft **2** tends to become higher than that of shaft **3**. On the other hand, would the speed of shaft **2** become lower than that of shaft **3**, then this latter being left independent would continue its proper motion carried on only by the inertia of the using apparatus.

Device A, in principle, is constituted of a crank **4** integral with shaft **2**; on the pin of the crank **4** is fitted the eye of the connecting rod having on

the other end a fork. The forked end of the connecting rod **5** is adjusted with the roller **6** that moves freely along radial slide plates **7** secured on the circular plate **8** integral with shaft **1**.

This device as shown, being provided with a single connecting rod and crank system, would completely be out of equilibrium: it would be necessary to have at least two symmetrical systems with their cranks at 180°. But for the sake of simplification of the description and having in sight that the conclusions must be the same whether we consider a single system or a compound one, we will continue our description of the device as above sketched.

On the other hand, the devices B and C to which we give the name of "mechanical filters" are using the principles known on the no-reversing and more particularly the improvements which are the object of the distinct patent taken by the same inventor bearing the title of: "Driving Device in One Direction Only, for Important Couples, with Rapid Frequencies of Action at High Speed".

The dynamic connection A produces a centrifugal force which acts on the whole mass M at the connecting rod bottom end A (figure 3), thus participating to the driving rotation in the direction of arrow f, so that the distances from the axis **0** depend on the angle formed by shaft **1** turning respectively to shaft **2**. In such a system there is independence between the two shafts, as it may be seen in the strict cinetic point of view, but their dynamic reactions take place under the centrifugal effect that tends to get away the mass M from the axis and consequently to decrease the angle GOB.

When the slide OG turns at the uniform angular velocity ω, one has to verify that the couple acting upon shaft **2**, consequently at the centrifugal effect, has sensibly the value

$$\Gamma=\frac{K}{2}\omega^2 \sin u \qquad (1)$$

in which formula u represents the angle BOG. This couple is either a working or a resisting one according to the positions of the crank and slide as shown in figures 3 and 4 respectively, that is to say, nearly a half revolution, when OB is retarded or in advance from OG.

Verification of the value K has to give:

$$K=2M\times L\times R \qquad (2)$$

(L and R representing the length of connecting rod and crank respectively), when the ratio

$$\frac{R}{L}$$

is supposed low.

The ratio of the relative shifting of shafts **2** and **1** is defined by the parameter u and, from that we have previously seen, it must be intuitively understood that for the value $u=0$ we shall have a relative stable equilibrium, in the case where shaft **2** is not subjected to any resistent couple Of course, when shaft **2** which momentaneously acts as a driven one, is subjected to the resistent couple ψ, yet, a relative equilibrium remains possible on the condition that ψ does not go beyond the maximum value

$$\frac{K}{2}\omega^2$$

of the couple Γ. The corresponding value of the parameter u is defined thus:

$$\sin u_0=\frac{2\psi}{K\omega^2} \qquad (3)$$

and the equilibrium will be stable so as if u_0 is taken for the acute angle fulfilling this condition (figure 5).

It is clear that it will be possible to observe oscillatory motions of u about the value of stable equilibrium $u=0$ (when ψ is naught or $u=u_0$ (when ψ is aught). These oscillatory motions are corresponding to the regimens of movements, which we shall name "engagings" (driving couples), of shafts **1** and **2**: shaft **2** accompanying shaft **1** in its rotation with an angular velocity oscillating around the mean value ω. It may be said, too, that there is "direct drive".

In order to have a driving couple (engaging) it is evidently necessary that the position of relative equilibrium u_0 exists. It is then absolutely indispensable that the resisting couple is sufficiently feable so as to fulfill the condition

$$\psi<\frac{K\omega^2}{2} \qquad (4)$$

but the limit of this value increases as the square of the angular velocity of the driving force.

We may consider, on the other hand, the possibility to get an "engaging" (driving couple) even starting from the state of rest of shaft **2**. A mathematical study in this case brings us to the following conditions:

$$\frac{C}{K}<2 \qquad (5)$$

C being the momentum of inertia of shaft **2**; this latter condition being only necessary as above said for the condition (4). It is possible for us, then, to say that C/K is the index T of the devices.

When an "engaging" (driving couple) does not occur, the angle u arrives at variations always in the same direction, the dynamic device connection becoming thus inefficient: the couple Γ which acts upon shaft **2** producing effects which are alternatively driver and driven, and shaft **2** being carried in the same direction of couple ψ keeps its mean movement without any alteration from the dynamic connection.

It is possible then to arrive at the conclusion that if the dynamic connection A puts in evidence the fundamental phenomenon of the "engaging" (driving couple), it is clear also that it has to be completed in order to be capable of being used for the transmission of power at variable speeds. This brings us to an exact explanation of the object of filters B and C.

The object of first filter B is to correct the insufficient dynamic connection when there is no "engaging" (no-driving couple). It produces the necessary actions so as to permit no movement of shaft **2** in the direction of the resisting couple, which direction we shall call negative, whereas it does permit these movements in the positive direction. Calculations put in evidence the following properties of the system completed by this first filter.

Now, let us consider only the case where shaft **2** is initially at rest:

1°—It will indefinitely remain at rest if we have:

$$\psi>\frac{K}{2}\omega^2$$

$$\frac{K}{2}\omega^2$$

being therefore the starting couple.

2°—If, on the contrary, we have:

$$\psi<\frac{K}{2}\omega^2$$

shaft 2 starts running in the positive direction. At the moment where u equals the value u_0 previously determined (Formula 3), then two cases are possible:

(a) For values lower than ψ and, at the condition (5) already mentioned that the index is less than 2, there is "engaging" (driving couple).

(b) For values higher than ψ, the turning of shaft 2 firstly accelerated, becomes then slow and finally stops, to start again when according to the relative shifting of shaft 1, the angle u takes again the value u_0. Thus we shall have a series of movements of shaft 2, identical to themselves but separated by intervals of rest. This is the regimen, to which we shall give the name of "disengaging couple."

This regimen, or rather the series of them are effectively well a transmission of power performed at variable speed of shaft 2. Nevertheless, all this is not sufficient so as the apparatus, though completed by the first filter B, be satisfactory.

The data of construction and the value of the resistent couple ψ determine the regimen, which will be established at the starting and will remain during the whole course of the movement, either a regimen of "disengaging" or an "engaging" one (driving). It is easy to note that in the driving case, starting from the state of rest of shaft 2, the angular velocity of this shaft varies periodically from 0 to 2ω, which is a quantity of variation too much greater.

The inconvenient that we have just now indicated is essentially theoretical, for we can rely on certain effects of inertia and elasticity in order to get practically an uniform angular velocity of shaft 2, but, other objections remain to be eliminated yet.

Shaft 2 working, as supposed until now, as a driven one, it is necessary to understand in its momentum of inertia C, the inertias of the using apparatus which must be actuated. It becomes then impossible to practically fulfill the condition

$$\frac{C}{K}<2$$

condition however necessary so as to get the driving couple (engaging): the ratio

$$\frac{C}{K}$$

becoming thus, generally, not only greater than 2, but even very much greater. Every regimen of "engaging" (driving coupling) will then be impossible, and it becomes easy to note that, when on regimen of "disengaging" the angular velocity of shaft 2 will be unable to go beyond the angular velocity of working power but only for a small fraction.

These difficulties are overcome by the application of the cinetic connection, not directly to driven shaft, but by means of an intermediate one of which the inertia can be easily chosen so as to have an index

$$\frac{C}{K}$$

smaller than 2. It becomes then necessary to provide a suitable connection between the intermediate shaft (shaft 2) and the new driven one (shaft 3).

The second filter C fulfills this condition: it is sufficient, so as to explain its action, to say that it carries the two shafts 2 and 3 together every time that, when the movements of these shafts are free, we have:

Angular velocity of 3—angular velocity of 2<0, it does not bring on the contrary any obstacle to the movements for which the previous difference is positive.

It is by means of this second filter, generally completed by the shaft of torsion 3, of which one of the principal advantages consists in the smoothing of working of the various organs, that transmission of power can be satisfactorily assured.

The mathematical study of the complete apparatus is a little more delicate than that applied to the cases previously examined. The value of the starting couple does not change, but in the discussion of the movement, we have to take in account two indexes: the one T′ of the whole which acts at the moments where filter (C) secures together the two shafts 2 and 3, the other T peculiar to shaft 2 and acting when filter (C) makes free shaft 3. This latter index is lower than 2, whereas the former T′ will be in the practical cases from 100 to 500 and even greater. The elasticity of the mechanism is such that the value T′ has but little to play in the transmission of power.

The analysis brings us to determine the relation between the ratio of reduction r (quotient of mean angular velocity of driven shaft by angular velocity ω of driving shaft) and the quotient q of the resisting couple by the starting one.

When q is lower than but very near to unity, we get regimens of "disengaging" of a small interest because they correspond to too small values of the reduction ratio r, in practical cases when the whole index T′ is great.

With values of q even smaller, we get regimens to which we shall give the name of "pseudo-engaging": in these regimens shaft 3 has a continued movement, produced by periodical impulsions of shaft 2, which virtue of the mode of action of the filters occur without any shock.

The state of "pseudo-engaging" is this which give to the assembly of devices its efficiency: they produce the whole series of reduction ratios from the driving coupling produced when the value q corresponds to a fraction of millimeter. The value q for the driving coupling (engaging) depends beside essentially on index T of shaft 2.

Thus, filter C plays a fundamental part: it is in virtue of its effects that we can get, when in practical case the index of the whole is great, firstly, regimen of "pseudo-engaging," and then, of "engaging" (driving coupling) when the resisting couple becomes reduced enough.

In fact, Figure 6 on plate 1 shows the practical transmissions of power when in "pseudo-engaging" condition (sliding coupling), with the assembly of devices, and for the following data (evaluations being understood: masses in kilograms and length in centimeters): speed OV of driving shaft=1,000 revolutions per minute,

$$K=2M\times L\times R=180$$

$$\Gamma\ \text{maximum}=\frac{K}{2}\omega^2=90\omega^2$$

We have taken successively $C_1=190$, $C_2=240$ and $C_3=300$; so that the index of shaft 2 is for each case respectively:

$$T_1=\frac{190}{180}=\frac{19}{18},\quad T_2=\frac{240}{180}=\frac{4}{3},\quad T_3=\frac{300}{180}=\frac{5}{3}$$

On the other hand, the index of the whole T′=300. At last, shaft 3 is rigid.

The curves V_1, V_2, V_3, correspond respectively to indexes T_1, T_2 and T_3.

It must be noted that when index of shaft **2** is nearer to **1**, the curve becomes nearly a rectilinear one, and that there is a feeble variation of the resisting couple from the immediately appreciable starting of shaft **3** to the coupling one in R_1.

But as soon as the index of shaft **2** becomes nearer to the value 2, the curves are bending their first half part, then increasing their bending course, they end in every case with a nearly straight part. In the three hypotheses considered, the starting couple remains always equal to $90\omega^2$.

It is also seen that the part played by index T of shaft **2** in the variation of couple at the moment of "engaging" (driving) and also the power transmitted are quickly decreasing as T comes nearer to value 2. This remark allows us to get at wall and within suitable limits, variations of the point corresponding to the "engaging" (driving coupling).

Curves S_1 and S_2 shown in Figure 7 plate **2** represent the powers practically transmitted when in regimen of "pseudo-engaging" with a rigid shaft **3**, having the same data as previously given, and with $T=4/3$ (speeds of motor equal to 1500 and 2000 revolutions per minute respectively). When rigid shaft **3** is substituted by a torsion one, the previous curves are modified as shown by the dotted ones S'_1 and S'_2 which only exist when the reduction ratio r remains inferior to ½ nearly.

These curves possess the following properties confirmed by calculations:

1°—With a rigid shaft **3**, and for the same reduction ratio, the powers transmitted, when in "pseudo-engaging, are the ones to the others as the cubes of the speeds of this shaft.

2°—With a torsion shaft **3** the previous ratio increases while the reduction one remains inferior to ½. This increase depends:

(*a*) On the possibility of torsion of shaft **3** within limits permitting to avoid breaking.

(*b*) On the ratio of the speeds of the motor shaft.

Thus, for

$$\frac{ON}{OB}=\frac{OM}{OA}$$

we have: with a rigid shaft **3**:

$$\frac{N_1N}{M_1M}=\frac{ON^3}{OM_3}$$

If this shaft shows any torsions, we have:

$$\frac{N_2N}{M_2M}>\frac{ON^3}{OM^3}$$

Particularly the points A_1, B_1, etc. ; ; are such that in all cases we have

$$\frac{B_1B}{A_1A}=\frac{OB^3}{OA^3}$$

They belong therefore to a curve P of the form $y=\alpha x^3$, which it will be easy to construct if one of the points are known. This curve determines, for the system under consideration, the powers at the moments of "engaging."

During the period of "engaging" or direct drive, which is corresponding, for example, to a speed of 1500 revolutions per minute of the motor, the power transmitted changes according to the line AA_1A_2, the point A_2 being defined by the couple maximum

$$\Gamma=\frac{K}{2}\omega^2$$

of the system which is also the starting couple, and thus we have:

$$A_2A=\frac{K}{2}\omega^3$$

In this regimen, for a resisting couple

$$\psi>\frac{K}{2}\omega^2$$

the apparatus breaks off and the shafts **2** and **3** take rapidly the rest position.

The lines such as B_2B, A_2A, are the ones to the others as the cubes of the angular velocities of motor shaft, that which enables us to write

$$\frac{B_2B}{A_2A}=\frac{OB^3}{OA^3}$$

Curve P_1, representing the maximum powers when in driving couple (engaging) is therefore easily constructed.

The curves P and P_1 are the boundaries of the three distinct regions T_1, T_2 and T_3.

Within region T_1 the powers transmitted, in state of equilibrium, occur necessarily when in regimen of "engaging" or direct drive, for the representative points can belong but to fractions of lines such as A_1A, B_1B, etc.

Within region T_2 it is possible to transmit powers in state of equilibrium, either when in regimen of "engaging" (direct drive) or when in regimen of "pseudo-engaging". In this case, effectively, the points may indifferently belong either to fractions of lines such as A_1A_2, B_1B_2, etc., or to fragments of curves S_1, S_2, etc. comprised between the principal curves P and P_1.

For this region one can easily pass from the direct drive regimen to the high ratio one; for that, it is sufficient to break down the established equilibrium by getting a rapid variation of the speed of the motor, either by accelerating if the motor does not give its whole power, or, in the other case, by firstly momently diminishing and then accelerating the speed.

It is seen, at last, that within the region T_3, the powers transmitted in state of equilibrium, are necessarily so when either on a regimen of "pseudo-engaging" or on a high ratio one.

This being said, let us consider now Figure 8, plate 3, in which are represented: the curve $OC_1I_1F_1$ of the powers of motor when fully loaded; the curve cf the corresponding specific consumptions, with the point I_2 as minimum; and the curve of utilisation of the car when on flat.

Let us take on curve $OC_1I_1N_1$, a point G of which the absciss OD is comprised between OF and OI, these latters giving speeds which by the whole opening of the main admission valve of the motor, correspond on one hand to the maximum of efficiency, and on the other hand to the minimum of consumption by HP hour. The choice of this point is left to the appreciation of the builder who will tend to have it nearer to F_1 for a racing car or to bring it back to I_1 for an utilitarian vehicle.

In all cases, the point G being determined as also the various elements before examined, it is possible to draw the curves P and P_1 already defined, the curve P passing by the point G.

The regions T_1, T_2, T_3, shown in Figure 7 are in this case clearly defined.

Thus region T_1 will be the curvilinear triangle TF_1G bounded at the top by the part of curve GF_1 as for the single regimen of direct drive possible, the maxium power transmitted changes as that of motor when full loaded. On the other hand, the power required for the car cannot be

inferior than the curve of utilisation on flat, unless on a declivity.

Region T_2 covers the curvilinear quadrilateral surface $OTGC_1$ and the curvilinear triangle C_1GH. The boundary at the top is formed by the portion of curve GE_3H, defined by points such as E_3. This latter represents the intersection of the curve S_3 (which corresponds to speed OE of motor which has in this case a limit power EE_1) with the line E_1E_3 parallel to the axis OT.

Within the quadrilateral surface $OTGC_1$ the power can indifferently be transmitted either when on direct drive or on self high ratio regimen, because the curve of the motor C_1G remains unpassed. But on regimen of "pseudo-engaging" and for the triangle C_1GH the power will inevitably be transmitted.

Region T_3 is delimited to the left, either by a portion of the curve S_4 (rigid shaft 3), or by a fraction of the curve S'_4 (torsion shaft 3). The boundary at the top is formed by the prolongation E_3F_3 or E_3F_4 of the curve GE_3 exactly defined already.

Summarily, it is possible to transmit power in state of equilibrium either obligatorily when on direct drive within the dotted part, or at will when on direct drive or on self high ratio within the cross lined part, or obligatorily when on self high ratio within the lined surface, this last one being able to be stretched to the left under the effect of torsion shaft **3**.

Figure 8 shows that the point G defines by its absciss OD the theoretical speed below which it is possible to pass on full load from the direct drive to the self high ratio regimen. The point C_1 gives the speed OC below which, by wholly opening the admission valve it is obligatorily passed from the direct drive to the "pseudo-engaging" regimen. At last, the points F_3 or F_4 specify the limit inferior speeds OK or OL which can be taken by the car with maximum speed and power of the motor according that shaft **3** is rigid or shows any torsions.

It is easy to verify that these limits correspond to all desirable necessities and leave to the driver a large choice in the faculty of using when on rise either the direct drive or the self high ratio regimen.

These explanations permit to see that all the working conditions indicated at the outset are fulfilled by the assembly of devices. We shall even add that the starting couple, depending solely on ω^2, for a determined device makes possible the using of maximum without any risk of stopping short the motor, for this latter furnishes power only when the car has motion. On the other hand, when the speed of motor is slow, the carrying couple is easily annihilated by the action of brakes which thus permits the suppression of the clutch.

It is easily conceived that the driving of the car becomes thus very more agreeable.

At last, the self high ratio combined with a judicious choice of point G, previously defined, permits an appreciable economy of fuel, particularly on lumpy roads.

In the application on motor-car, the assembly of devices is always completed by a cardan joint, which mounted near the origin of shaft 3 enables this latter to follow the vertical displacements of the geared back axle. On the other hand, any reversing mechanism whatever, with a dead point, placed generally on shaft **3**, permits to obtain the reversing of running of the car and if wanted to make the motor completely free.

The no-reversing of the mechanical filters prevents any movement of the car when this latter, left with its motor stopped, tends to make intermediate shaft **3** to turn reversedly from its single direction. Thus, when on upward slope, any stopping, either wanted or no, does not require the acting of brakes to prevent the car to run back. It is also possible, without the aid of brakes to prevent any running of the car when on downward slope, by putting on the reverse.

Description of the first assembly of devices Plates 4 and 5 (Figures 9—10—11 and 12)

In order to facilitate the description of this first assembly, Figure 9 represents the two parts of a longitudinal section of the devices splitted through **42—42**; Figures 10 and 11, cross sections of Figure 9 through **43—43** and **44—44**, the latter showing a fractional part on a greater scale; and Figure 12 gives two views of plate springs.

At first sight, one sees the three shafts **1**, **2** and **3**, independent on the same axis.

Device A shown at bottom of Figure 9 is in this case constituted of two symmetrical connecting rods acting upon two eccentric carriages located within a hollow fly wheel.

The devices B and C, represented at the top of Figure 9, are concentrically fitted; B being the exterior and C the interior one. This arrangement permits to shorten the length of the device.

The motor shaft **1** is provided at its end with a fly-wheel formed by two disks **4** and **5**, secured together by two portions of a crown **6** and **7** which go into grooves **8'** and **9'** of the disks and receive the assembling gudgeons **10**.

The parts **6** and **7** leave between them two symmetrical windows **8** and **9** parallel to the axis of shafts. In the sides of these windows, mortises **11** are made so that they are facing two by two and which are receiving the blocks **12**, in hardened steel of T section. The blocks **12** being secured on parts **6** and **7** by means of the assembling gudgeons **13**.

The blocks **12** are forming two radial slides in which play freely the rollers **14** of the connecting rods **15**. The ends of these latters constitute quadrangular parts **16**, shaped as forks **17** receiving the shafts of rollers **14** generally constituted by ball or roller bearings. The lateral ends of the interior sides of the forks **17** into which partially enter the blocks **12**, perform the guiding of the connecting rods.

The reamings **19** made in the connecting rods **15** receive the eccentric carriages **20** forged and integral with shaft **2**. Small rollers **21** are distantly placed between the reamings **19** and the carriages **20**, laterally guided by the flanges **22**. This arrangement frequently employed on roller bearings permits to have for film of oil a small coefficient of friction. In the same purpose balls can also be used.

The connecting rods and the eccentric carriages are made of special steel with their working surfaces greatly hardened.

As already seen, shaft **2** has on it the two carriages **20** of the same eccentricity set exactly up at 180%. This shaft goes in and passes through the disks **4** and **5** of the fly-wheel and turns on the ball bearings **23** and **24**.

The devices B and C are constituted of the fixed collar bracket **25** shut by the covers **26** and **27**, the whole forming a tight box.

The right hand cover **26** is provided with a bronze plug **28** and a roller bearing **29**, acting as guides and brackets of shaft **2**; this latter having

on its left hand extremity a muff **30** of which the prolongation forms the hollow cylinder **31**.

The left hand cover **27** is also provided with a bronze plug **32** and a roller bearing **33**, acting as guides of shaft **3**. The cylindrical cup **34** which ends the shaft **3** enters freely into the hollow shaft **31** and receives the end of shaft **2** by means of the ball bearing **35**.

Within the fixed collar bracket **25** is placed a bush **36** having on each of its extremities a series of claws **37** which enter into claws similarly shaped made on interior flanges of the covers **26** and **27**, securing thus the bush with the covers.

The two washers **38—39** fitted within the covers act as lateral thrust bearing for parts turning inside the tight box.

The exterior of the cup **34** and the interior of the bush **36** are longitudinally castellated according to the profiles shown by Figure 11. Each groove receives two consecutive small rollers **40**, kept in contact with the working surfaces by the flat springs **41** which take their fulcrums on the radiant flanges **42** of the grooves. This arrangement is furthermore included in a distinct Patent No. P. V. 12.515 taken in France on the January 25, 1940 (Driving Device in One Direction Only, for Important Couples, with Rapid Frequencies of Action at High Speed).

In the exposed application, shaft **2** can turn but only in the same direction F as does the motor shaft **1** and insures in that direction the driving of shaft **3**.

The parts moving within the tight box have all their working surfaces greatly hardened.

The assembly of devices is completed by a forced lubrication system. Oil arrives within a groove of bronze plug **28**, goes through passages made on shaft **3** and is distributed to all the shifting parts, then is projected or flows to the exterior.

A tight chamber, not shown on the drawings, receives this oil which after being filtered performs again and indefinitely the same circuit.

The working of this assembly is the previously exposed one.

Description of a second assembly of devices Plates 6 and 7 (Figures 13–14–15 and 16)

For this second assembly, Figure 13 represents a complete longitudinal section, splitted through **45—45**, and Figures 14, 15 and 16 cross sections of Figure 13 through **46—46**, **47—47** and **48—48** respectively. The two last fractional sections are drawn on a greater scale.

We find again at the bottom of Figure 13 the device A and at the top the devices B and C, which in this case are established the one after the other.

Here device A is sensibly the same as the one already described. The hollow fly-wheel is also formed by two disks **4** and **5** secured together by two portions of crown **6** and **7**. We find again the two windows **8** and **9** parallel to the axis of shafts, and the blocks **10** of rectangular section, forming two by two the radial slides into which the rollers **11** and the connecting rod **12** are shifting.

The connecting rods are both maintained laterally the one by the other and by the interior faces of the disks **4** and **5**; thus the guiding action being better, though of course insured by the blocks **10** as in the first assembly already described.

The reamings **13**, with the flanges **14**, made on the connecting rods, receive the eccentrical carriages **15** integral with shaft **2** by means of the small rollers **16** maintained laterally by the flanges **14**.

Shaft **2** has its right hand end guided within the disk **4** by means of the roller bearing **17** and passes through the disk **5** by means of the bearing **18**.

Left hand end of shaft **2** is provided with a connecting plate **19** receiving a long sleeve **20** at the end of which two series of claws **21** and **22** are made according to the profiles shown in Figures 15 and 16. In this case each claw receives three consecutive small rollers **23**.

A fixed bracket sleeve **24** receives forcedly fitted on it a jacket **25** and the races of bearings **26**, **27** and **28**. The roller bearings **26** and **27** bearing and centering the long sleeve **20** inside the jacket. However for reasons of building and fitting up, the hub of roller bearing **27** is forcedly adjusted on a splitted ring **29** placed in a central groove of the sleeve **20**.

Roller bearing **28** receives the end of the hollow cylinder **30**, exterior and concentrical to the left hand part of the sleeve **20**. This cylinder is secured on plate **31** integral with shaft **3** and is centered inside the sleeve **20** by means of the bearing **32**. A stem **33**, also integral with shaft **3**, is provided with a thrust bearing **34** having its fulcrum on the interior flange of sleeve **20**. This device completes the longitudinal connection between the shafts **2** and **3**.

A cylindrical part **35** secured on the left end of bracket **24** insures the lateral holding of the races of bearings **27** and **28** and forms a chamber to receive the lubricating oil flowing and furthermore insures the keeping tight of the passage of revolving cylinder **30**.

A washer placed to the right of bracket **24** insures the holding of the race of roll bearing **26**.

The forced oil which arrives into bearing bracket **37** of shaft **1**, penetrates successively into central holes bored on shafts **1** and **2**. This oil is then distributed within the connecting rods and fills the inside of sleeve **20**. The small holes bored on this sleeve are communicating with the small chambers provided between the rollers **23** and the radiant flanges of grooves **39**. The result is that the forced oil which can flow towards the exterior through the holes **40** produces thus a slight thrusting effect behind each roller and thus insures to them a permanent contact with the working surfaces. Furthermore, the rollers **23** placed on the exterior of the castellated sleeve **20**, during the acceleration of shaft **2**, utilise their respective force of inertia so as to augment the efficiency of the engagings and disengagings respectively. These improvements are precisely indicated in the patent previously mentioned.

A tight chamber, not shown on the drawings, receives the oil which after being filtered performs again the same circuit.

The working of this second assembly remains the same.

BAPTISTIN BRANDA.

PUBLISHED

JUNE 15, 1943.

BY A. P. C.

B. BRANDA

ASSEMBLY OF DEVICES PERMITTING A RATIONAL TRANSMISSION OF MECHANICAL POWER, PARTICULARLY FITTED FOR MOTOR-CARS

Filed Jan. 8, 1941

Serial No. 373,705

7 Sheets-Sheet 1

Fig. 1.

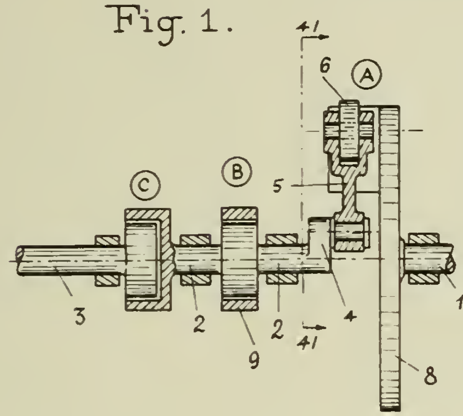


Fig. 2.

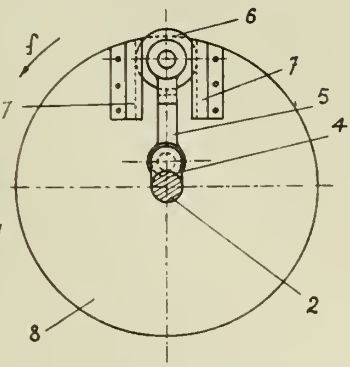


Fig. 3.

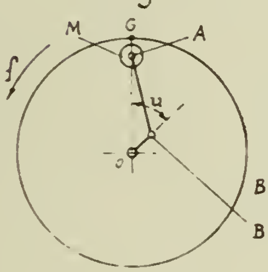


Fig. 4.

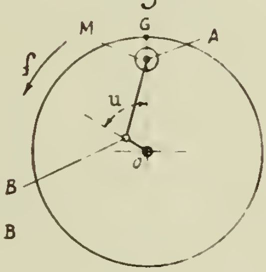


Fig. 5.

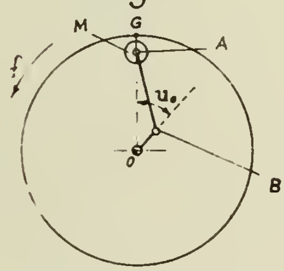
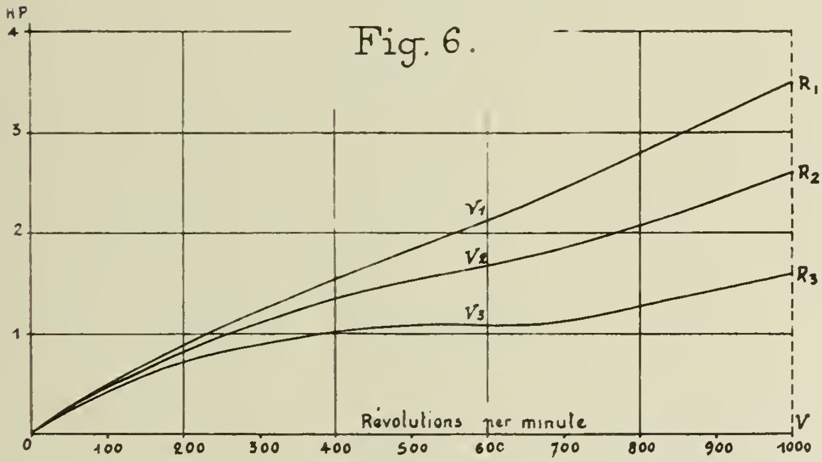


Fig. 6.



INVENTOR
BAPTISTIN BRANDA

By Haseltine, Lake & Co
Attorneys

PUBLISHED

JUNE 15, 1943.

BY A. P. C.

B. BRANDA

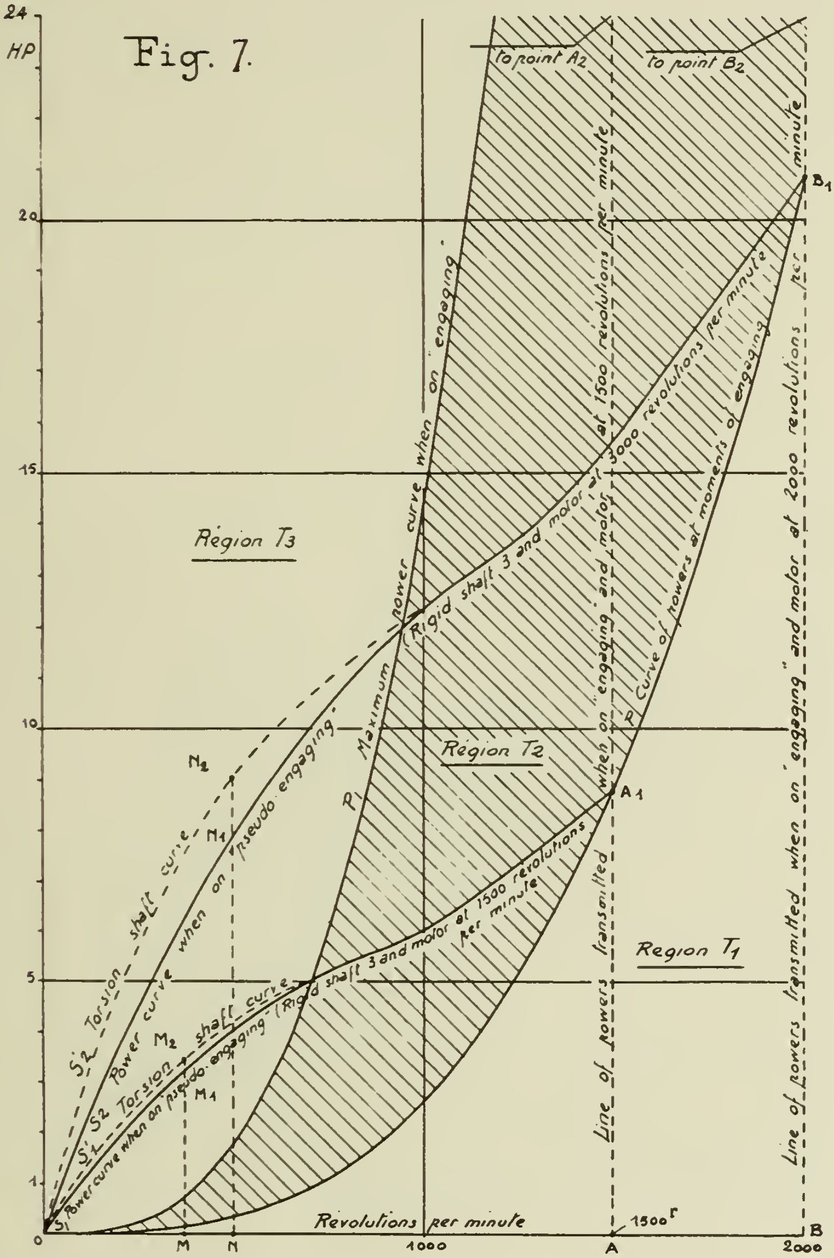
ASSEMBLY OF DEVICES PERMITTING A RATIONAL TRANSMISSION OF MECHANICAL POWER, PARTICULARLY FITTED FOR MOTOR-CARS

Filed Jan. 8, 1941

Serial No. 373,705

7 Sheets-Sheet 2

Fig. 7.



INVENTOR
BAPTISTIN BRANDA

By Haseltine, Lake & Co.
Attorneys

PUBLISHED

JUNE 15, 1943.

BY A. P. C.

B. BRANDA

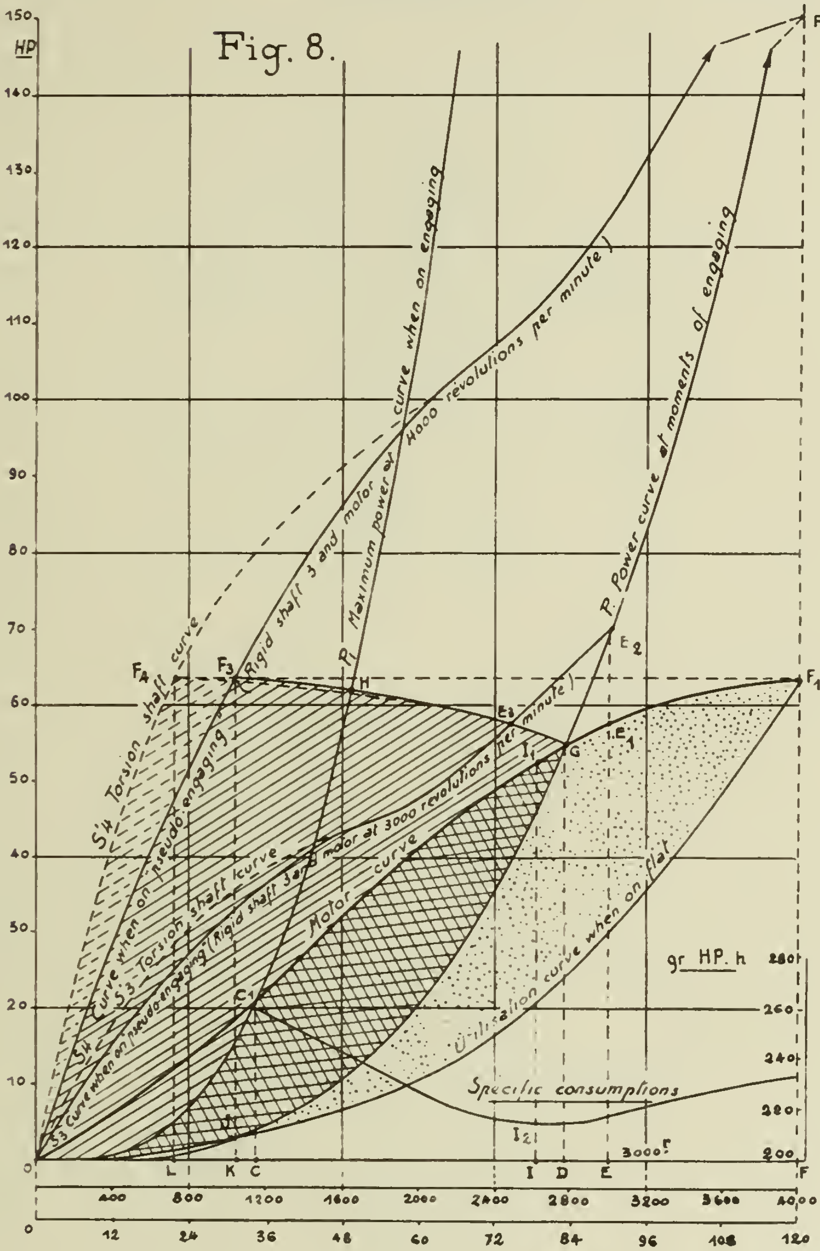
ASSEMBLY OF DEVICES PERMITTING A RATIONAL TRANSMISSION OF MECHANICAL POWER, PARTICULARLY FITTED FOR MOTOR-CARS

Filed Jan. 8, 1941

Serial No. 373,705

7 Sheets-Sheet 3

Fig. 8.



INVENTOR
BAPTISTIN BRANDA

By Haseltine, Lake & Co.
Attorneys

PUBLISHED

JUNE 15, 1943.

BY A. P. C.

B. BRANDA

ASSEMBLY OF DEVICES PERMITTING A RATIONAL TRANSMISSION OF MECHANICAL POWER, PARTICULARLY FITTED FOR MOTOR-CARS

Filed Jan. 8, 1941

Serial No. 373,705

7 Sheets-Sheet 4

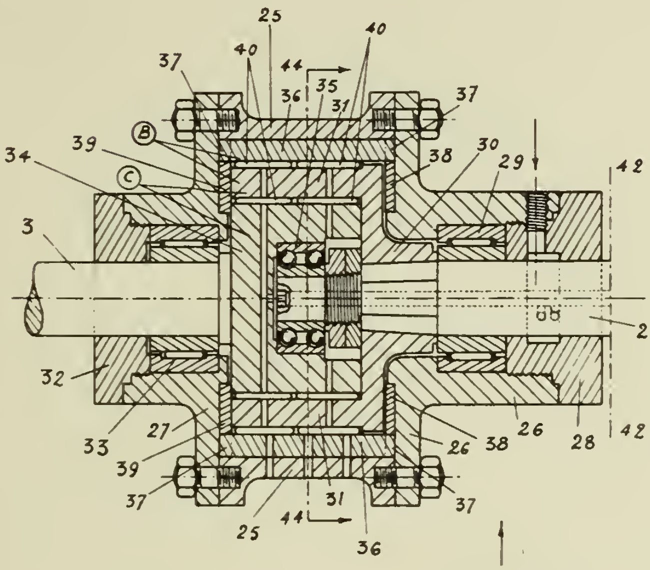
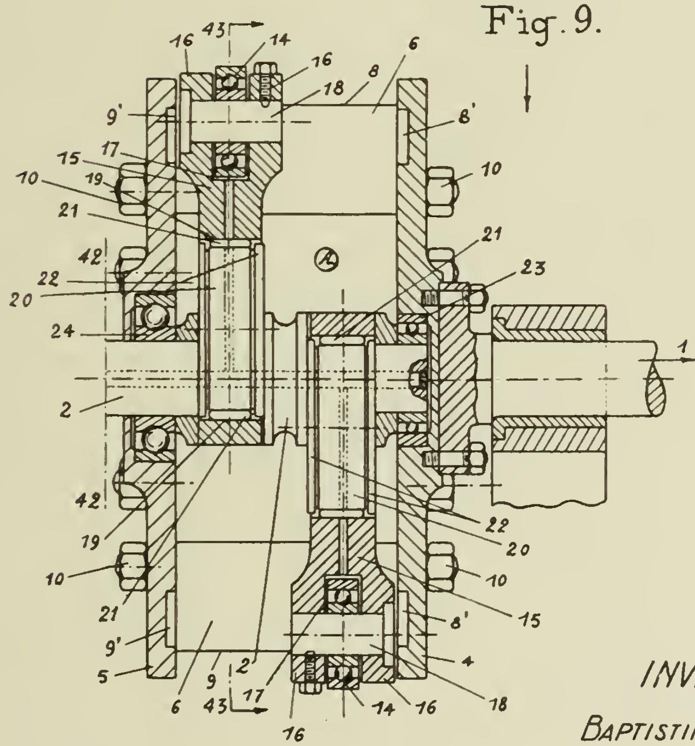


Fig. 9.



INVENTOR
BAPTISTIN BRANDA

By Haseltine, Lake & Co
Attorneys

PUBLISHED

JUNE 15, 1943.

BY A. P. C.

B. BRANDA

ASSEMBLY OF DEVICES PERMITTING A RATIONAL TRANSMISSION OF MECHANICAL POWER, PARTICULARLY FITTED FOR MOTOR-CARS

Filed Jan. 8, 1941

Serial No. 373,705

7 Sheets-Sheet 5

Fig. 10.

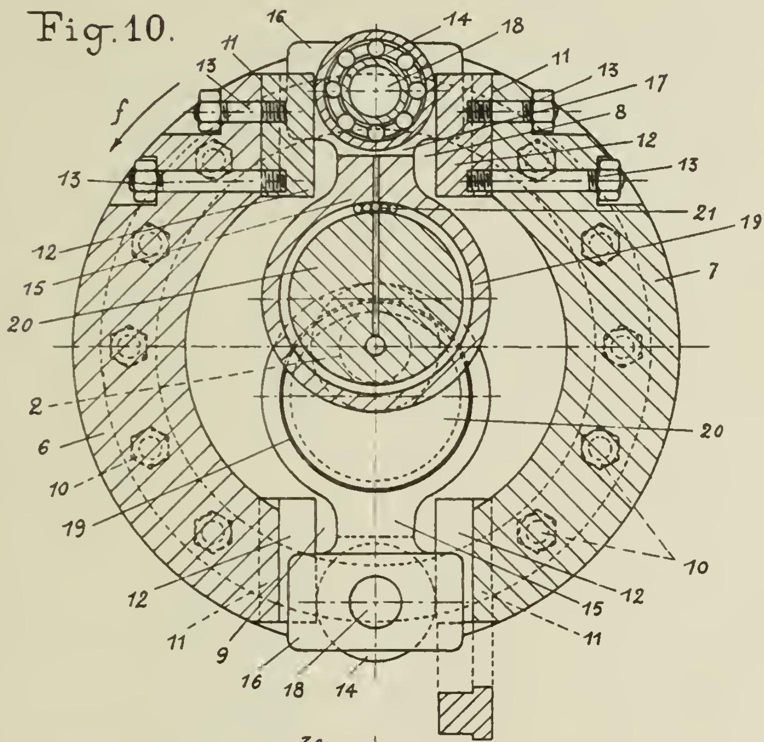


Fig. 11.

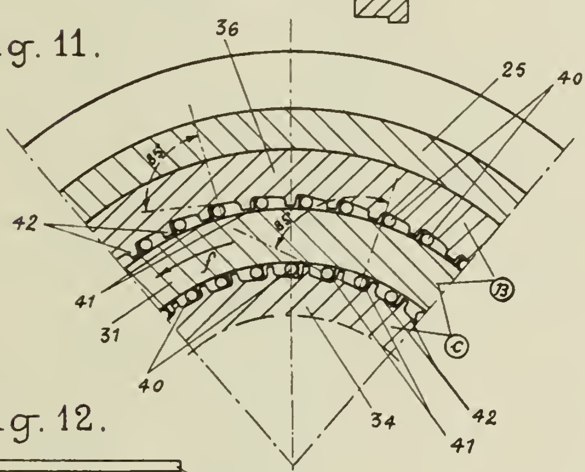


Fig. 12.

INVENTOR
BAPTISTIN BRANDA

By: Haseltine, Lake & Co
Attorneys

PUBLISHED

JUNE 15, 1943.

BY A. P. C.

B. BRANDA

ASSEMBLY OF DEVICES PERMITTING A RATIONAL TRANSMISSION OF MECHANICAL POWER, PARTICULARLY FITTED FOR MOTOR-CARS

Filed Jan. 8, 1941

Serial No. 373,705

7 Sheets-Sheet 6

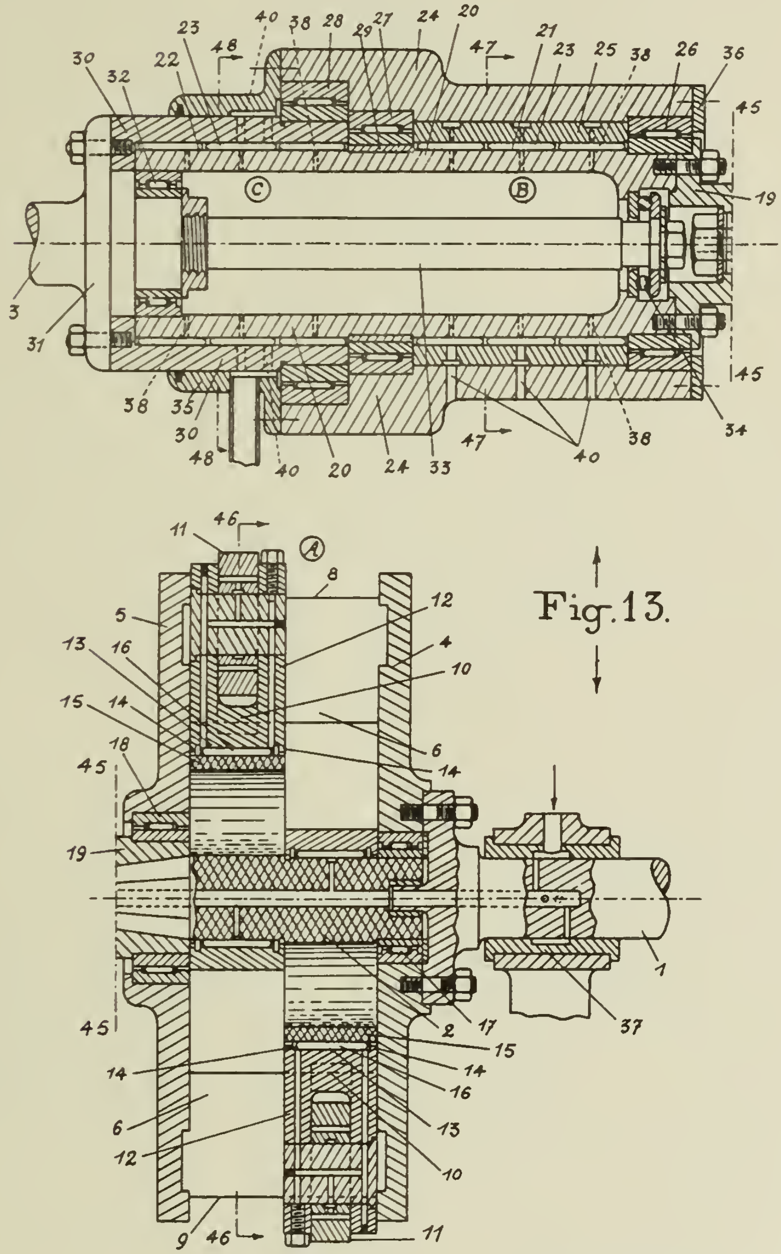


Fig. 13.

INVENTOR
BAPTISTIN BRANDA

By: Haseltine, Lake & Co
Attorneys

PUBLISHED

JUNE 15, 1943.

BY A. P. C.

B. BRANDA

ASSEMBLY OF DEVICES PERMITTING A RATIONAL TRANSMISSION OF MECHANICAL POWER, PARTICULARLY FITTED FOR MOTOR-CARS

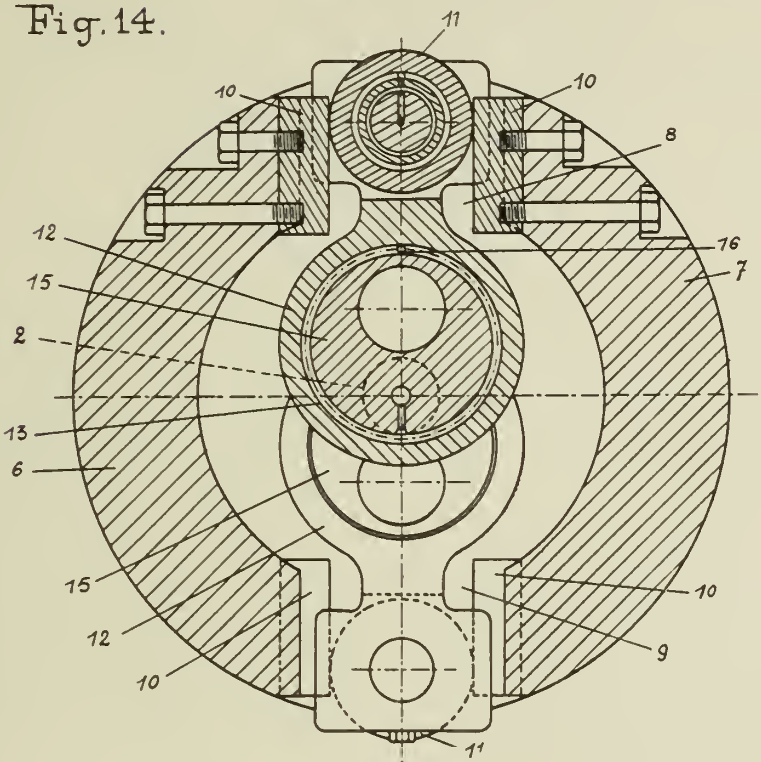
Filed Jan. 8, 1941

Serial No.

373,705

7 Sheets-Sheet 7

Fig. 14.



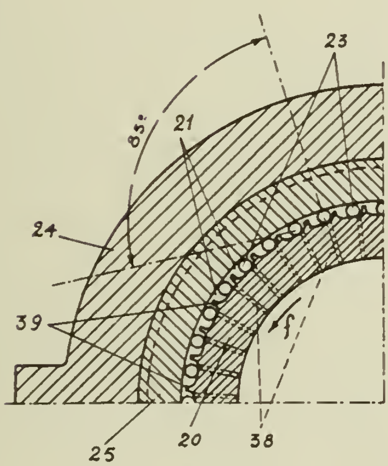


Fig. 15.

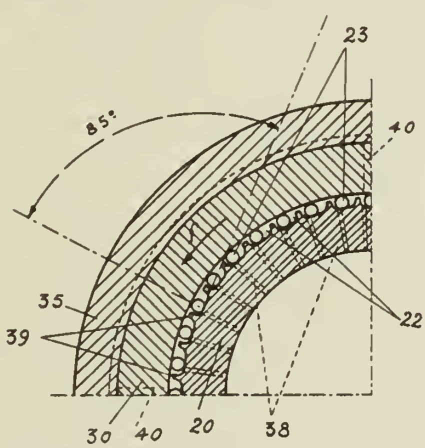


Fig. 16.

INVENTOR
BAPTISTIN BRANDA

By Haseltine, Lake & Co
Attorneys

Published June 15, 1943

Serial No. 374,800

ALIEN PROPERTY CUSTODIAN

DEVICES FEEDING WITH AIR THE EXPLOSION CHAMBER OF INTERNAL COMBUSTION MOTORS

André Perreau, Lyons, France; vested in the Alien Property Custodian

Application filed January 17, 1941

This invention relates to an improved device feeding with air the explosion chamber of internal combustion motors.

In the explosion chamber of the internal combustion motors, it is difficult to secure a complete combustion of the liquid introduced at any speed of the motor. In order to bring a sufficient quantity of air into contact with the jet or jets of the fuel the operator must endeavour to bring into whirling the air molecules during all the duration of the admission and of the compression in the cylinder.

The appliance for the introduction of air into the explosion room of internal combustion motors which constitutes the object of the invention provides the necessary means to favour and to create an increased and controlled whirling of the admitted air round the injector of the liquid fuel.

It is characterized by the fact that two or more valves are disposed in the cylinder with respect to the injector in points quite diametrically opposed, if there are two only, to admit the air-current arriving from the exterior through distinct pipes. These distinct pipes for air-feeding have their inlet orifices situated, by preference, on both sides of the motor in order to introduce into the cylinder two air-currents having different temperatures and pressures and capable of favouring the combustion at any speed at which the motor revolves.

The explosion chamber may, moreover, be divided into two parts the volume ratio of which takes into account the admission of air, and the jets are conceived in such a manner as to bring the totality of the injected liquid to a complete combustion. Thus, this arrangement of the feeding valves and of the injector may be used in combination with a piston the bottom of which comprises a suitable hollow in order to serve as air reserve for certain critical working cases of the motor from the point of view of the combustion.

At last, the feeding device may also be used in combination with an injector disposed in such a manner as to secure the diffusion of any liquid in the air brought into increased and controlled whirling without that the sides of the cylinder head nor those of the hollow of the piston, if it exists, may be attained.

The invention will be well understood by the aid of the following description and the annexed schematical drawing which are given by way of example.

Fig. 1 is a plane-view seen from below.

Fig. 2 is a sectional view according to 2—2 of the Fig. 1 of a device comprising two distinct admission valves.

Fig. 3 shows a section of a device by the aid of which it is possible to introduce air, under various pressures, into the admission valves.

Fig. 4 is a sectional view of an explosion chamber divided into two parts with two admission valves.

Two distinct admission valves 2 and 3 are foreseen in the device represented on Figs. 1 and 2. Air arrives at the valve 2 by the pipe 4 distinct from that designated by 5 which feeds the valve 3.

The axles of the valves seen in 6 and 7 Fig. 1 are situated in nearly diametrically opposed points with respect to the injector 8. It results from this arrangement that the admitted air-currents follow, on the one hand, the arrows x, and on the other hand the arrows y, what gives them a whirling motion round the injector 8.

As the drawing shows, the air-current enters on the left respectively on the right of the motor. The left inlet 9 has been foreseen in the vicinity of the evacuation orifice 10. The air-current entering in 9 may be at a temperature superior or lower to that entering on the right by the pipe 5 if a heating system 12 is disposed in a suitable manner, this heating system forcing the air-current to run along the exterior sides of the exhaust pipe 13.

A sectional view of a device bringing the air-current to the admission valves under different pressures obtained either by compression or by depression, is represented on Fig. 13. A pipe 14 brings to the valve 2 an air-current compressed by the aid of a mechanical system such as a compressor, a ventilator or by any other means giving to the air-current a pressure superior to the atmospheric pressure. Besides this arrangement and independently of it, the valve 3 may be fed with air under the pressure inferior to that of the ambient air by working a system such as the throttle valve 15 which obstructs in part or in totality the feeding pipe 16 of the ambient air to the pipe of the valve 3.

Fig. 4 shows how the explosion chamber is divided into two principal parts the one of which is constituted by the principal cylindrical volume 17 formed by the bottom of the piston 11 and the sides of the cylinder head and of the cylinder, the other by a revolving volume or cavity 18 having a suitable shape and foreseen in the bottom of the piston. When the piston performs its motions these two volumes bring about a whirling which adds to the gyroscopic motion resulting

from the two distinct air entrances foreseen in the arrangement.

One of the characteristical features of the invention is, moreover, given by the fact that the jets 19 and 20 of the injector 8 are imagined in such a manner that the increased and controlled whirling, as said above, hinders the jets from striking the sides of the explosion chamber and make the best use of the cavity, without entering it, constituting an air reserve in the piston for certain critical cases from the point of view of the combustion. In this manner, the totality of the injected liquid is brought to a complete combustion.

ANDRÉ PERREAU.

PUBLISHED
JUNE 15, 1943.
BY A. P. C.

A. PERREAU
DEVICES FEEDING WITH AIR THE EXPLOSION CHAMBER
OF INTERNAL COMBUSTION MOTORS
Filed Jan. 17, 1941

Serial No.
374,800

Fig.1

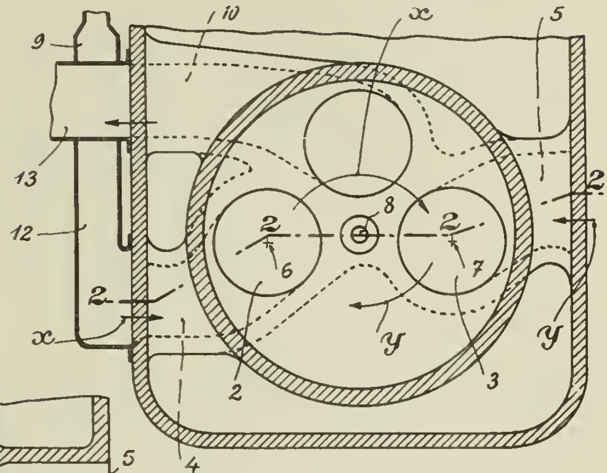


Fig.2

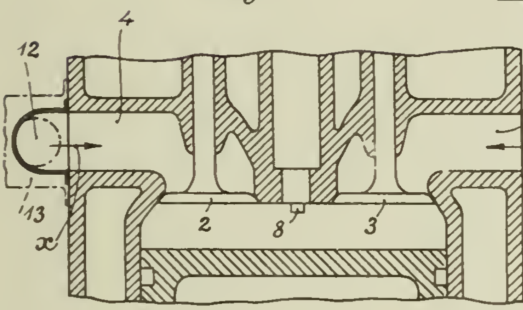


Fig.3

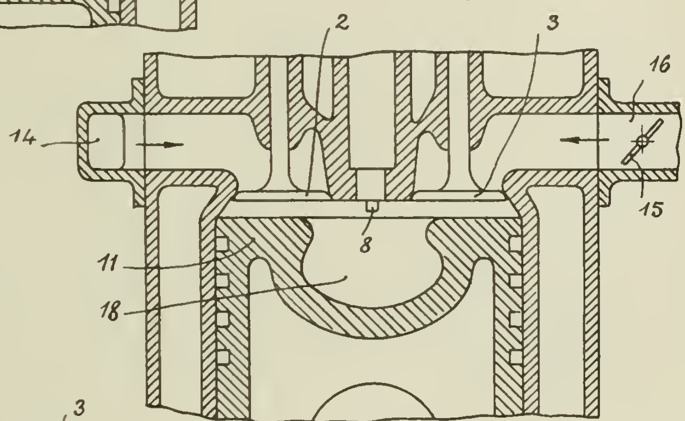
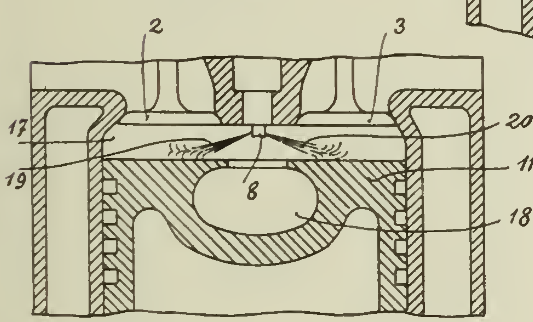


Fig.4



Inventor:
ANDRÉ PERREAU
By Haseltine, Lake & Co.
Attorneys.

Published June 15, 1943 Serial No. 374,950

ALIEN PROPERTY CUSTODIAN

APPARATUS FOR PRODUCING AN ELECTRICAL MAGNITUDE TO BE MEASURED OR CONTROLLED

Rudolf Schobelt, Berlin-Lichterfelde West, Germany; vested in the Alien Property Custodian

Application filed January 17, 1941

This invention relates to an apparatus for producing an electrical magnitude to be measured or controlled, such as, for instance, a voltage or a current in accordance with small mechanical displacements, the latter being transmitted to an electrode, for instance, to the grid of an electronic tube. To this end, any electrode of the tube may be employed, for instance, the cathode, the grid or the anode. In this manner the change of the anode current caused by the change in position may directly or indirectly operate a measuring instrument, relay or other measuring apparatus.

A possibility of bringing about relatively great changes in the anode current with the aid of small displacements consists according to the invention in movably arranging a grid of an electronic tube with respect to a second grid in parallel relation to the plane in which the grid lies, i. e., the displacement is effected perpendicularly to the direction of the electron current. The displacements in the direction of the plane in which the grid lies are very advantageous, since the voltage amplification factor of the anode is considerably varied owing to this shearing movement. The grids may be impressed with a different potential, for instance, a control grid and a space charge grid may be employed; however, the grids may also be directly connected to one another.

Further details of the invention will be apparent from the following description taken in connection with the accompanying drawings, in which are shown two forms of the invention.

Fig. 1 shows a measuring apparatus in which the displacement of a plate is to be determined, and

Fig. 2 a measuring apparatus in which the displacement to be measured is directly produced in the electronic tube itself.

Referring to Fig. 1, 1 denotes plate directly connected to the grid 2 of an electronic tube 3 made of metal. The tube 3 is provided with two resilient and gas-tight metal diaphragms 4 and 5 which establish a connection of the plate 1 with the grid 2 while permitting at the same time this grid to be displaced. In this case the grid 2 constitutes the central portion of a rigid frame 6 secured between the diaphragms 4 and 5. By arranging this frame between the diaphragms the apparatus is released of the outer air pressure so that changes in the air pressure do not influence the movement of the control grid 2.

The grid 2 is arranged close to the stationary grid 7 of the electron tube in such a manner that upon the mutual movement of the grids 2 and 7 the voltage amplification factor of the anode 8 may be varied between 10 and 100%. The anode 8 is secured to the casing 3 of the electronic tube with the aid of an insulating member 9 and is connected through a testing instrument 10 to the positive pole of a battery 11, which at the same time supplies the heating voltage to the electron emitting source 12. This is secured to the casing 3 of the electronic tube by means of insulating members 13. The entire electronic tube is connected to ground so that the grids are also impressed with the same voltage, i. e., earth potential.

The testing apparatus is secured to a base plate 14 which carries in the upright 15 a screw spindle 16 whose displacement may be measured with the aid of a drum 17. The apparatus may, for instance, be employed for measuring the thickness of a body in which any bodies may be inserted between the measuring spindle 16 and the plate 1. When reducing the distance between the spindle and plate a contact is brought about at a given moment which causes a displacement of the plate 1 and therefore of the grid 2 with respect to the grid 7. During this displacement the voltage amplification factor of the electron tube varies so that the anode current indicated by the testing instrument 10 varies also. In this manner it is possible to accurately ascertain the moment at which the contact takes place. On the other hand, the instrument may also be employed to determine, for instance, changes in the thickness of the body to be tested which manifest themselves in a displacement of the control grid 2. In the case of a suitable calibration of the apparatus the change in the anode current is directly a measure for the displacement of the plate 1. Care should be taken to attain with the aid of the adjustable battery terminals and of the voltages varied thereby, a suitable position and shape of the characteristic of the electron tube which is adapted as to the sensitiveness and the initial position to the measurements to be carried out.

While in the just described arrangement the movement of the elements displaceable with respect to one another must be introduced into the electronic tube, for which purpose any known movable construction is suitable, the arrangement may also be so designed that the displacements to be measured are directly obtained in the electronic tube or that the latter at least represents the reference element of the displacement to be determined.

Such an arrangement is shown in Fig. 2, in

which 18 denotes an electron-emitting source secured in the metallic tube 20 to a holder 19 with the aid of an insulator 21. The heating filament of the electron-emitting source is supplied with energy produced by the transformer 22. The electron-emitting source 18 surrounds a displaceably mounted grid 23 secured at the one end to a mass 25 through an insulating member 24, the mass being guided in the tube 20, for instance, by a diaphragm 31. At the other end, the grid 23 is secured to a spring 26 which is also supported by the tube 20 through an insulating member 21. The forces of the spring and the mass 25 are so balanced that the grid 23 is maintained in its central position.

The grid 23 is surrounded by another grid 27 which is so designed that the free cross-section for the electrons emitting from the cathode 18 is varied upon the longitudinal displacement of the grid 23.

The grid 27 is also firmly secured to the casing 20 of the tube through the holder 28 and the insulating member 21. The cathode 18, the grids 23 and 27 as well as the tube 20 constitute the electrodes of an electron tube if the space within the tube 20 is completely exhausted. The testing instrument 30 by means of which changes in the anode current may be determined is inserted in the anode circuit which is energized by the battery 29.

The above-described instrument is, for instance, adapted to measure deflections or accelerations of the tube 20 depending upon whether the natural frequency of the oscillatory system formed of the spring 26 and of the mass 25 is higher or lower than the frequency impressed on the tube 20. The mutual displacement of the two grids corresponds directly to the deflections or accelerations of the tube 20 which may be indicated in the testing instrument 30 by varying the anode current. Instead of this instrument also other testing devices may be employed, such as, for instance, relays.

It is also possible to design the grid 23 itself in the form of a mass. Such a grid is particularly advantageous, since the entire construction of the testing apparatus is simplified by the direct combination of the electrodes with the displaceable elements.

Also a layer from which the electrons are released with the aid of the photo-electric effect may be employed as an electron-emitting source in an apparatus according to the invention. Such arrangements are usual in electron multipliers in which an amplification takes place by utilizing the secondary emission. In this case the grid which is so arranged as to carry out a shearing movement and which is controlled by the measurements may be employed to control the secondary stream of electrons, whereby a very high power amplification ratio may be employed in the tube.

RUDOLF SCHOBELT.

PUBLISHED

JUNE 15, 1943.

BY A. P. C.

R. SCHOBELT

APPARATUS FOR PRODUCING AN ELECTRICAL MAGNITUDE TO BE MEASURED OR CONTROLLED

Filed Jan. 17, 1941

Serial No. 374,950

Fig. 1

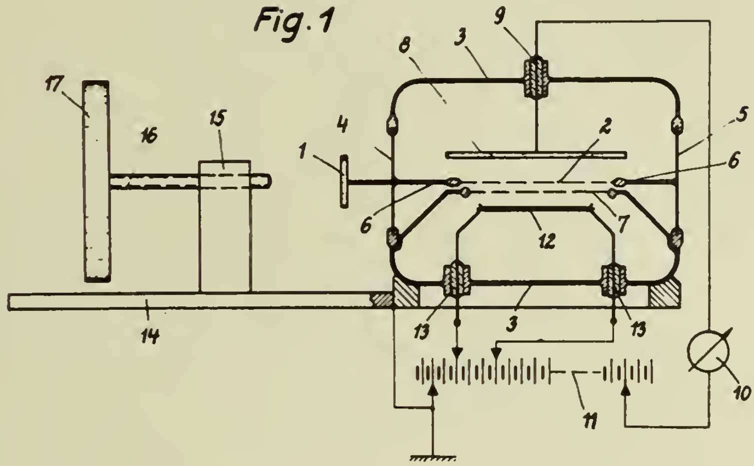
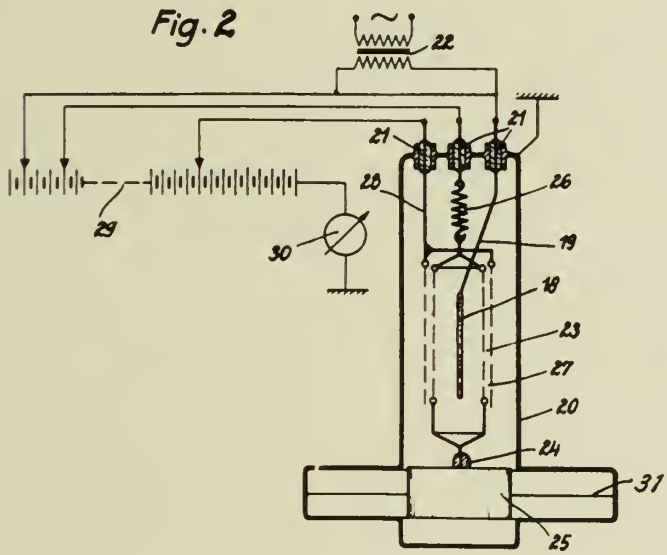


Fig. 2



Inventor:
Rudolf Schobelt
By Richardson and ... Att'ys

455.

Published June 15, 1943

Serial No. 374,864

ALIEN PROPERTY CUSTODIAN

PIMELIC ACID DERIVATIVES DISUBSTITUTED IN THE γ-POSITION AND A PROCESS OF PREPARING SAME

Georg Wiest, Ludwigshafen-on-Rhine, and Heinrich Glaser, Bonn, Germany; vested in the Alien Property Custodian

No Drawing. Application filed January 17, 1941

The present invention relates to pimelic acid derivatives disubstituted in the γ-position and a process of preparing same.

We have found that pimelic acid derivatives, i. e. pimelic acid diesters, diamides and pimelic acid dinitrile, which are disubstituted in the γ-position may be prepared very easily and with good yields by causing a functional derivative of a carboxylic acid containing a reactive CH_2-group in α-position to the modified carboxylic acid group to act on more than the equimolecular amount of a functional derivative of acrylic acid, in particular of acrylic acid nitrile, an acrylic acid ester or an acrylic acid amide, in the presence of an alkaline catalyst.

Functional carboxylic acid derivatives containing a reactive CH_2-group are in particular the esters, amides and nitriles of acetic acid the methyl group of which is substituted by a radicle containing multiple bonds, the latter being attached to the atom which is adjacent to the CH_2-group. Such radicles which are sometimes defined as acidifying radicles are for example the

$$-C{\equiv}N,\quad >C{=}O,\quad \text{or}\quad -N{\lesssim}^{O}_{O}$$

group and aryl radicles. Suitable starting materials of this kind are for example the esters, amides and nitrile of cyanoacetic acid, aceto acetic acid, malonic acid or phenyl acetic acid.

Suitable functional derivatives of acrylic acid are acrylic acid nitrile, acrylic acid methyl, ethyl or butyl ester and other alkyl esters, acrylic acid amide, acrylic acid methyl amide and other amides derived from primary or secondary amines.

The reaction consists in the addition of two molecular proportions of the acrylic acid derivative to one molecular proportion of the carboxylic acid derivative containing a reactive CH_2-group and proceeds in accordance with the following equation showing the reaction between acrylic acid nitrile and cyano acetic acid ethyl ester:

$$2CH_2{=}CH{-}CN + NC{-}CH_2{-}COOC_2H_5 \longrightarrow NC{-}CH_2{-}CH_2{-}\underset{\substack{|\\ COOC_2H_5}}{\overset{\substack{CN\\ |}}{C}}{-}CH_2{-}CH_2CN$$

γ-cyano pimelic acid dinitrile-γ-carboxylic acid ethyl ester

The reaction products therefore constitute functional derivatives of pimelic acid which are disubstituted in the γ-position, one substituent being a modified carboxylic acid group, the other being a radicle containing multiple bonds. They correspond to the general formula:

$$X{-}CH_2{-}CH_2{-}\underset{\substack{|\\ Z}}{\overset{\substack{Y\\ |}}{C}}{-}CH_2{-}CH_2X$$

wherein X and Z stand for modified carboxylic acid groups, and Y stands for the radicle containing multiple bonds.

In addition to these bimolecular addition products there may be formed as by-products compounds formed by the addition of one molecular proportion of the acrylic acid derivative to one molecular proportion of the carboxylic acid derivative containing a reactive CH_2-group, in particular if less than two molecular proportions of the acrylic acid derivative are allowed to act on one molecular proportion of the other starting material. These monomolecular addition products may easily be converted into bimolecular addition products by bringing them into contact with acrylic acid derivatives in the presence of alkaline catalysts. It is also possible to add these monomolecular addition products to the starting materials used in the practice of our invention.

The amount of monomolecular addition product in the reaction mixture depends on the nature of the starting materials actually used. For example, when bringing into contact acrylic acid nitrile with cyano acetic acid ethyl ester, the bimolecular product is almost exclusively formed even if using only a slight excess of acrylic acid nitrile over cyano acetic acid ethyl ester. Under these conditions only part of the ester will react, the remaining amount being left unchanged. On the other hand, when allowing one molecular proportion of aceto acetic acid ethyl ester to act on little more than one molecular proportion of acrylic acid nitrile, both addition products will be found in the reaction mixture. It is, therefore, preferable to use at least two molecular proportions of the acrylic acid derivatives for one molecular proportion of the other starting material, if it is intended to obtain a reaction product containing the bimolecular addition product on the main constituent.

The reaction may be carried out in the presence of substances inhibiting the polymerization of acrylic acid derivatives, e. g. copper, hydroquinone and the like.

The addition of acrylic acid derivatives to carboxylic acid derivatives containing CH_2-groups proceeds so smoothly that the reaction may be started simply by adding one of the starting ma-

terials to the other starting material admixed with the catalyst. The reaction proceeds with the evolution of heat. Since acrylic acid derivatives are liable to be polymerized at high temperatures, exceeding about 100° C, preferably those exceeding 70° C, should not be used. If necessary, the reaction mixture has to be cooled during the reaction. When the vigor of the reaction has abated, it may be suitable to gently heat the reaction mixture in order to accelerate the reaction. The reaction may be carried out in the presence of inert solvents or diluents.

Various alkaline substances may serve as the catalyst. Thus, the alkali and alkaline earth metals themselves and their compounds having an alkaline reaction are suitable, for example, their oxides, hydroxides or alcoholates. Basic nitrogen compounds may also be used, as for example pyridine. The amount of catalyst to be used may be very small; generally speaking few per cents or less than one per cent thereof, calculated on the amount of the carboxylic acid derivative containing a reactive CH_2-group are sufficient. It is not necessary and does not offer any advantage to use an amount corresponding to more than 10 per cent of the acid derivative. When using alkali metals as the alkaline catalyst, the course of the reaction is even unfavorably affected by using large amounts, e. g. more than 50 per cent, of the catalyst. For example, when using an amount of alkali metal equimolecular to the amount of the carboxylic acid derivative containing a reactive CH_2-group which amount would correspond for example to the use of sodium cyano acetic acid ester, two molecular proportions of the acrylic acid derivative are no longer added.

The products obtainable according to our invention may be used for the production of disubstituted pimelic acids by saponifying the modified carboxylic acid groups. The esters of these pimelic acids are most suitable as plasticizers or solvents.

The following examples will further illustrate how our invention may be carried out in practice. The invention, however, is not restricted to these examples. The parts are by weight

Example 1

530 parts of acrylic acid nitrile are allowed to flow into 800 parts of malonic acid diethyl ester to which 1 part of metallic sodium has been added, while stirring vigorously. The temperature is kept at 30–40° C. After having allowed the reaction mixture to stand for 12 hours, it is diluted with chloroform and extracted several times with water to which a small amount of acetic acid has been added. The chloroform solution is dried with anhydrous sodium sulfate, the chloroform distilled off, and the residue distilled in vacuo. After unchanged starting materials have been distilled off, there are obtained 450 parts of a colorless liquid, boiling at 133–134° C uider 3 millimeters pressure, constituting the monomolecular addition product ω-cyanethyl malonic acid diethyl ester, and 130 parts of a colorless oily liquid, boiling at 210–212° C under 5 millimeters pressure which constitutes pimelic acid dinitrile-γ,γ-dicarboxylic acid diethyl ester:

$$\begin{array}{c} COOC_2H_5 \\ | \\ NC-CH_2-CH_2-C-CH_2-CH_2-CN \\ | \\ COOC_2H_5 \end{array}$$

Example 2

1 part of metallic sodium is added to 1130 parts of cyano acetic acid ethyl ester. 1060 parts of acrylic acid nitrile are allowed to flow drop by drop into the mixture while stirring. The temperature is kept at 40° C by cooling. The reaction mixture is allowed to stand for several hours in the course of which it solidifies to colorless crystals, melting at 36–37° C and boiling at 221° C under a pressure of 3.5 millimeters. The addition product constitutes γ-cyano-pimelic acid dinitrile-γ-carboxylic acid ethyl ester:

$$\begin{array}{c} CN \\ | \\ NC-CH_2-CH_2-C-CH_2-CH_2-CN \\ | \\ COOC_2H_5 \end{array}$$

Example 3

1060 parts of acrylic acid nitrile are allowed to flow drop by drop into a mixture of 1300 parts of aceto acetic acid ethyl ester with 1 part of sodium while stirring and cooling to 30 to 40° C. The reaction mixture is then stirred for 6 hours at 60° C. When working up in the manner described in Example 1, there are obtained 950 parts of unchanged starting materials, 450 parts of a colorless liquid boiling at 135.5° C under a pressure of 4 millimeters (ω-cyano ethyl aceto acetic acid ethyl ester) and 650 parts of an oily liquid, boiling at 191–193° C under a pressure of 2 millimeters, which constitutes γ-(1'-oxo-ethyl)-pimelic acid dinitrile-γ-carboxylic acid ethyl ester and corresponds to the formula:

$$\begin{array}{c} COCH_3 \\ | \\ NC-CH_2-CH_2-C-CH_2-CH_2-CN \\ | \\ COOC_2H_5 \end{array}$$

Example 4

106 parts of acrylic acid nitrile are added to a mixture of 117 parts of phenyl acetic acid nitrile with 0.5 part of metallic sodium at 50–60° C. There is formed a viscous pale-brown oil which crystallizes after being allowed to stand for several hours. By adding a small amount of methanol the formation of crystals may be favored. 175 parts of γ-cyano-γ-phenyl pimelic acid dinitrile:

$$\begin{array}{c} C_6H_5 \\ | \\ NC-CH_2-CH_2-C-CH_2-CH_2-CN \\ | \\ CN \end{array}$$

are thus obtained.

Example 5

A mixture of 55 parts of cyano acetic acid ethyl ester, 0.5 part of cyclohexylamine and 53 parts of acrylic acid nitrile is stirred for 5 hours at 50° C. By distilling the reaction mixture under reduced pressure there are obtained 46 parts of the compound described in Example 2.

The same compound may be prepared in the following manner:

110 parts of cyano acetic acid ethyl ester, 0.5 part of sodium hydroxide and 106 parts of acrylic acid nitrile are stirred at 40° C. 5 parts of water are added and carbon dioxide is introduced at 50° C until it is no longer absorbed. The mixture is then dried with anhydrous sodium sulfate, filtered off and distilled.

Example 6

900 parts of acrylic acid butyl ester are allowed to flow drop by drop into a mixture of 510 parts of cyano acetic acid ethyl ester with 0.5 part of metallic sodium while stirring and cooling to 30–40° C. The temperature is then raised to 60° C, and the whole stirred for 6 hours. After the addition of a small amount of water, carbon di-

oxide is introduced until it is no longer absorbed. The mixture is dried with anhydrous sodium sulfate and distilled in vacuo. After a small amount of starting material has been distilled off, there is obtained in excellent yields γ-cyano pimelic acid dibutyl ester-γ-carboxylic acid ethyl ester:

$$\begin{array}{c} CN \\ | \\ H_9C_4OOC-CH_2-CH_2-C-CH_2-CH_2-COOC_4H_9 \\ | \\ COOC_2H_5 \end{array}$$

It boils at 202–203° C under a pressure of 1.5 millimeters.

When using acrylic acid ethyl ester instead of the butyl ester, there is obtained γ-cyano pimelic acid diethyl ester-γ-carboxylic acid ethyl ester. (Boiling point 163–167° C under 0.5 millimeter pressure.)

Example 7

650 parts of acrylic acid methyl ester are allowed to flow into a mixture of 390 parts of aceto acetic acid ethyl ester with 2 parts of metallic sodium at 45–50° C while stirring. After having allowed the mixture to stand at 60° C for 4 hours, 9 parts of hydrochloric acid are added. The mixture is dried and distilled. After unchanged acrylic acid methyl ester has been distilled off, there are obtained 741 parts of a colorless liquid boiling at 168–172° C under 0.8 millimeter pressure. It constitutes γ-(1′-oxo-ethyl)-pimelic acid dimethyl ester-γ-carboxylic acid ethyl ester and corresponds to the following formula:

$$\begin{array}{c} CH_3 \\ | \\ CO \\ | \\ H_3COOC-CH_2-CH_2-C-CH_2-CH_2-COOCH_3 \\ | \\ COOC_2H_5 \end{array}$$

When using acrylic acid ethyl ester or butyl ester, there are obtained the corresponding pimelic acid diethyl ester (boiling point 192–193° C under 2 millimeters pressure) or dibutyl ester (boiling point 200–208° C under 2 millimeters pressure).

Example 8

1150 parts of acrylic acid methyl ester are allowed to flow slowly into a mixture of 950 parts of malonic acid diethyl ester with 9 parts of metallic sodium while stirring and cooling to 30–40° C. The reaction mixture is then stirred at 50° C for five hours, neutralized by the addition of concentrated hydrochloric acid and distilled under reduced pressure. After unchanged acrylic acid methyl ester has been distilled off there are obtained 1800 parts of pimelic acid dimethyl ester-γ,γ-dicarboxylic acid ethyl ester

$$\begin{array}{c} COOC_2H_5 \\ | \\ H_3COOC-CH_2-CH_2-C-CH_2-CH_2-COOCH_3 \\ | \\ COOC_2H_5 \end{array}$$

It boils at 180–190° C under 1 millimeter pressure. The oily distillate solidifies to form white crystals.

Instead of acrylic acid methyl ester there may be used a corresponding amount of acrylic acid ethyl or butyl ester. There are thus obtained pimelic acid diethyl ester-γ,γ-dicarboxylic acid ethyl ester (distilling at 192–197° C at 2 millimeters pressure) or pimelic acid dibutyl ester-γ,γ-dicarboxylic acid ethyl ester (distilling at 208–210 C at 1.5 millimeters pressure).

GEORG WIEST.
HEINRICH GLASER.

Published June 15, 1943

Serial No. 374,882

ALIEN PROPERTY CUSTODIAN

CLUTCH FOR AUTOMOBILES

Rudolf Fuchs, Brunn, Moravia; vested in the Alien Property Custodian

Application filed January 17, 1941

Clutches for use in automobiles are known, which clutches are let in when a certain speed of the motor has been reached.

It is further known to let in motor car clutches automatically, by the aid of damping devices, no shocks being caused thereby.

The present invention relates to a combination of such known devices, in which combination disengagement of the clutch may be effected at any speed desired and even at stillstand of the automobile driving engine.

In the drawing, three embodiments of the invention are shown by way of example. In each of these three types, disengagement of the clutch is electrically effected.

Fig. 1 illustrates a shock absorber acting by the aid of an air damper, the control of the electric current being obtained from a relay.

Figs. 2 and 2*a* show a shock absorber operated by friction, the control of the current being effected by a centrifugal governor.

Fig. 3 shows a device controlling the current by means of a vacuum.

Obviously, the means used for controlling the electric current which in the first embodiment (Fig. 1) is a relay, in the second embodiment (Fig. 2) is a centrifugal governor, and in the third embodiment (Fig. 3) is partial vacuum, may be interchanged in any way desired so that, for example, the first device, instead of by a relay, may be actuated by a centrifugal governor or a vacuum, and vice versa.

In Fig. 1, a bar **1** acting on the clutch (not shown in the drawing) is articulated to a lever **2** which has its fulcrum at **3**. At one end of the lever, at **6**, is mounted a shock absorber **6** (known per se) such as, for instance, an automatic and noiseless door closer, acting by the aid of an air damper. Lever **2** is provided with a jawed lug **5** acting as the armature of an electromagnet **4**. To such electromagnet, current is supplied from the storage battery of the automobile. Switching in or off of the current is effected by a coil **7**, to which current is fed from the light generator of the vehicle. One end +D of the coil is connected to the positive pole of the generator, while the other end is connected to the electric mass of the vehicle, which mass is permanently connected to the negative pole of the generator. When the speed of the engine of the vehicle is low, the tension of the generator will be so small that a spring **8** arranged opposite coil **7**, and secured at **9**, cannot be attracted, so that it will be in the position shown in the drawing. In this position, the spring is, by its other extremity, applied to a contact **10** connected to the positive pole +B of the storage battery. Thus, the current of the battery will pass through spring **8** and, by **9**, through the winding of the electromagnet **4**, and, from there, through the cut-off switch **13** to the electrical mass of the vehicle. Thereby, bar **1**, in a direction opposite the arrow, is brought into the position shown, in which the armature **5** has been attracted by the magnet. This position corresponds to the disengagement of the clutch. When the tension of the light-generator increases, due to an increase of the speed of the engine of the vehicle, spring **8** is attracted by the coil **7**, the contact is interrupted at **10**, and the spring is connected to a stop **11**. Thereby, the electromagnet **4** becomes currentless, the force attracting the armature **5** will be stopped, and damper **6** attracts bar **1** in the direction of the arrow, whereby the clutch is softly let in.

In order to enable the clutch to be released when the speed of the engine has not yet sufficiently decreased to bring spring **8** into the position shown, a switch **12** is provided, which is connected to a gas lever, so that, if the gas supply be completely cut off, the said switch is thrown into circuit. The battery current may now flow through the electromagnet **4**, the spring **8** being avoided. Such operation of the clutch will take place, for example, when the car is started, for the purpose of changing the speed. When descending, even at the greatest speed of the vehicle, the number of revolutions of the motor will be but small, and therefor, only little fuel will be consumed.

The clutch as shown in Figs. 2 and 2*a* substantially distinguishes itself from the type as shown in Fig. 1 by that, at the end of a lever **15**, a toothed segment **17** is arranged which meshes with a gear **18**, which together with a larger gear **19** is mounted on a gear shaft. The said larger gear meshes with a pinion **20** mounted on the shaft of an electromotor **21**. When this electromotor has been started, lever **15** is moved to the right and into the position shown in the drawing. A stop **22** will prevent the said lever from progressing. In this position the clutch is disengaged. Since, as a rule, the device will not remain in this position longer than a few seconds, there is no danger that the motor might be burnt. In case, however, that release of the clutch should take more time, a special device would be required, which is not described here. Engagement of the clutch is effected if a bar **14** is moved in the direction of the arrow, by the

strength of springs arranged in the usual manner in the clutch operating device. The shock absorber as used in this embodiment is shown in Fig. 2*a*. On the shaft of the electromotor is secured a free wheel disc 26 which in the shown direction of rotation drives a drum 27. This drum is provided with arms 28, on which are pivoted weights 29 fitted to a fixedly arranged jacket 16. When rotating, the weights, due to the centrifugal force, are pressed against the fixed jacket 16, and friction is produced, which brakes the rotation. Owing to the free wheeling system 26, such braking only takes place when bar 14 is moved in the direction of the arrow, while when the clutch is released, the shock absorber is non-operative, and the releasing movement will therefor take place at an undiminished velocity.

Control of the electric current which causes the disengaging movement of the clutch, is, in the type as shown in Fig. 2, effected in another manner than in the embodiment shown in Fig. 1, namely, not through a relay, but by means of a centrifugal governor 23 driven by the engine of the vehicle. If the speed of the motor is low, a conducting connection is set up at 23 between the controls of the governor and a contact 24. Thereby, this contact is conductively connected with the bulk of the vehicle, and also one pole of the electromotor. The other pole is connected, at +B to the storage battery, so that the motor is started. At a higher speed of the engine of the vehicle the conducting connection is interrupted, at 25, and the clutch is let in. Switch 30 serves the same purpose as switch 12 of Fig. 1.

In Fig. 3, a third type of control member for the electric current is illustrated, which serves to disengage the clutch. In this case, partial vacuum is used for controling purposes, and the vacuum may be taken from the suction pipe of the automobile driving engine.

31 is a casing closed by a membrane 32 and whose interior is connected with the suction pipe of the engine, so that, when the said engine is operative, there is, in the casing, a vacuum which will move the membrane inward. On the membrane is arranged a contact pin 33 facing another contact pin 34 which, due to a screw thread, is adjustable within a fixed base 35, to which the thread is conductively connected. From the battery 36 of the car, the electric line 37 is led to an electromotor M which corresponds to motor 21 of Fig. 2 or to a magnet which corresponds to magnet 4 of Fig. 1 or another suitable device adapted to electrically effect disengagement of the clutch. From the motor M, the line 38 is led to base 35, and the other pole of the battery 36 is connected with the bulk of the vehicle. At a very low speed or stillstand of the vehicle, the vacuum in the suction line is either very little or nought, so that a conductive connection between the contact pins 33 and 34 is effected. Thus the electric current will cause the clutch to be disengaged. At a relatively high speed of the engine of the vehicle, the current between the contact pins 33 and 34 is interrupted and the clutch let in. As an auxiliary switch, in the manner of switches 12 and 30 in Figs. 1 and 2, serves in this case a contact made between a disc 39 and a contact pin 40, when the foot 41 has been sufficiently removed from the gas pedal 43. The disc 39 is mounted on a bolt 43, which ends in a plate 44. This plate 44 must be depressed by the foot before the latter touches plate 45 of the gas pedal, if the engine of the vehicle is to be started. Thereby the contact between 39 and 40 is interrupted, so that engagement of the coupling will be initiated before the engine of the vehicle has reached so high a speed that the pressure below atmospheric could let in the clutch. On the other hand, when the vehicle is descending, the clutch is released, when the foot is lifted from plate 40.

RUDOLF FUCHS.

PUBLISHED
JUNE 15, 1943.
BY A. P. C.

R. FUCHS
CLUTCH FOR AUTOMOBILES
Filed Jan. 17, 1941

Serial No.
374,882

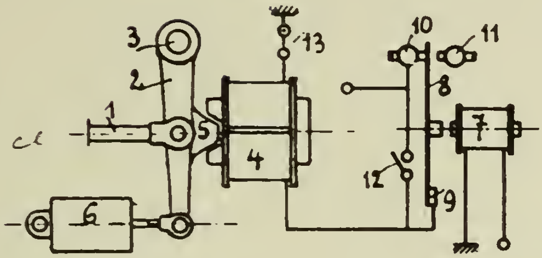


Fig 1.

Fig. 2.

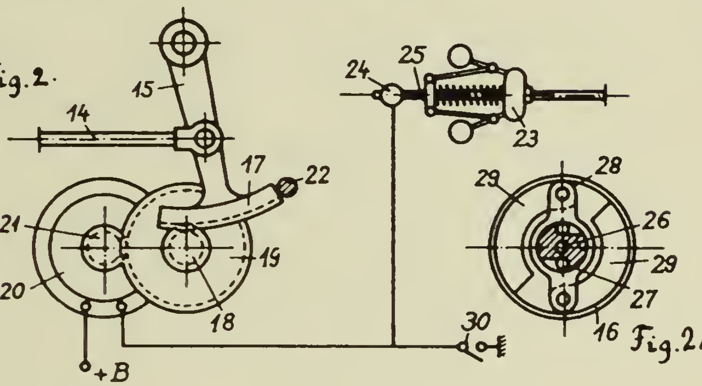
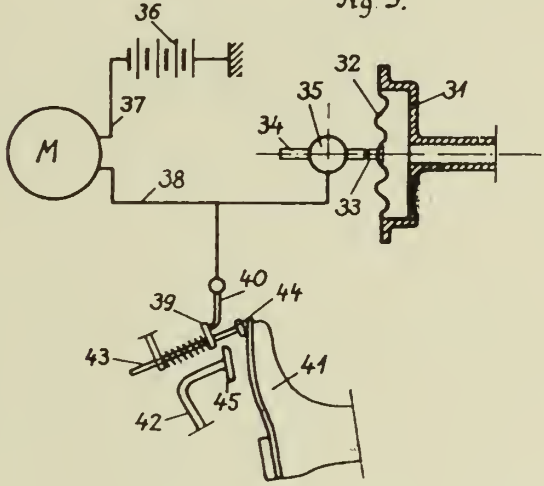


Fig. 2a.

Fig. 3.



Published June 15, 1943

Serial No. 381,153

ALIEN PROPERTY CUSTODIAN

SHOCK-ABSORBING DEVICES OF THE FRICTIONAL TYPE

Georges Dreyfus, Montauban, France; vested in the Alien Property Custodian

Application filed February 28, 1941

The present invention relates to shock-absorbing devices of the frictional type, such in particular as are to be used in connection with parachutes in order to absorb the shock produced on the belt or harness when the parachute opens.

The object of the present invention is to produce a device of this kind, which is better adapted to meet the requirements of practice than those used for the same purpose up to the present time and, in particular, which is simpler and more efficient than the other shock-absorbing devices.

According to an important feature of the invention, in order to absorb the energy of the shock, the device includes at least one flexible part, such as a strap, a cable, a rope, etc., which is caused to pass successively through a plurality of orifices, the whole being arranged in such manner that the displacement of the said part through said orifices creates frictional stresses which produce the desired shock-absorbing action.

Other features of the present invention will be hereinafter described with reference to the accompanying drawings given merely by way of example, and in which:

Fig. 1 is an elevational view of a shock-absorbing device for parachutes according to the present invention, said device being shown in connection with the various elements of the parachute with which it is to cooperate;

Fig. 2 is a sectional view of line II—II of Fig. 1;

Fig. 3 is a view analogous to Fig. 1, showing another embodiment of the invention;

Fig. 4 is a section of the line IV—IV of Fig. 3;

Fig. 5 is a vertical sectional view of a modification of these devices.

The following description of my invention will be made with reference to a shock-absorbing device adapted for use in connection with a parachute, for absorbing the shock resulting from the opening of said parachute. However, it should be well understood that the invention is in no way limited to this application and that it might be used in connection with other apparatus than parachutes.

The device according to the invention includes at least one flexible part 1 adapted to pass successively through several orifices provided in at least one suitable support 3. The whole is interposed between the parachute proper and the harness or belt through which the pilot is supported so that the shock resulting from the opening of the parachute causes the flexible part to slide in these orifices so as to produce a friction capable of absorbing the shock.

The specific construction of such a device may of course correspond to many different embodiments.

For instance, the flexible part or parts abovementioned may be made either of a textile material or of a combination of several textile materials (cotton, silk, hemp, etc.) or, again, of a combination of textiles and other materials.

Said part or parts 1 may be made of any suitable shape and section.

For instance, in the embodiment illustrated by Figs. 1 and 2, there is a single flexible element consisting of a strap 1 passing through elongated apertures 2. In other embodiments of the invention, such for instance as those illustrated by Figs. 3, 4 and 5, I provide one or several flexible elements 1, which may be for instance of circular, oval or similar shape, this rounded shape being advantageous in particular when there is a plurality of flexible elements. These elements consist for instance of cables, ropes or the like, which pass through a series of holes 2 and I may provide a single element passing through each hole 2 or several elements extending through the same hole.

These holes or apertures 2 are provided in at least one piece 3, suitably connected to the parachute or to the harness or belt of the parachute according as said flexible elements are themselves carried by said harness or belt or by said parachute respectively. Piece 3 is made either of metal, preferably good conductor of heat, or of a textile material, or again of any other suitable material or combination of materials.

If necessary, supplementary means, such for instance as cooling fins, may be provided for improving the evacuation of the calories produced by the shock-absorbing friction in the course of the operation.

In the drawings, it has been supposed that the flexible element or elements 1 were connected, at least at one end, to a loop 4 secured to the lower end of the ropes 5 which are directly fixed to the periphery of the parachute proper. This loop might be constituted by a portion of said ropes. The other end of element or elements 1 is then either loose or fixed to the harness or belt of the parachute.

On the other hand, in the embodiment illustrated by the drawings, piece 3 is connected to said harness or belt, for instance through a strap 6.

Concerning now the section to be given to apertures 2 with reference to the section of the element or elements 1 that pass through said apertures, the following remark should be made:

Up to the present time, in the shock-absorbing devices of the friction type, a strap or cable had to be wedged in a holding piece with respect to which it slided. In the present invention, it is not at all necessary to give apertures 2 a section equal to or smaller than that of the flexible element engaged therein as it would be the case if such a wedging had to be obtained.

On the contrary, it is advantageous to make the aperture or apertures of piece 3 of a section

greater than that of the element or elements passing therethrough. This greatly facilitates the assembly of the parts and has no detrimental effect on the working of the system since the flexible element, in view of the sinuous shape of the path through which it has to move, is caused to slide with a considerable friction against at least the edges of the apertures when said flexible element is violently pulled by the opening of the parachute.

Of course, in order to avoid breaking by shearing said edges of the apertures are made of convex rounded shape as shown by Figs. 1 to 4, and any way they are so arranged as to include surfaces which are in substantially tangential contact with the corresponding surfaces of the flexible element.

Eventually, as shown by Fig. 5, the inner surfaces of said apertures may be given directions corresponding to those which the corresponding portions of the flexible elements tend to assume under the effect of a shock.

Concerning the distance *d* to be left between two successive holes, it will be easy for any person skilled in the art to determine the optimum value thereof in accordance in particular with the nature of the flexible element that is used. For instance, it seems that when flexible element **1** is a strap such as shown by Fig. 1, with apertures **2** of a width *e* averaging several millimeters, it is advantageous to choose a distance *d* averaging 12 m/m, this indication being of course given merely by way of example. Eventually this distance *d* might be variable for the apertures or holes co-acting with the same flexible elements or for the apertures coacting with two different flexible elements.

Advantageously, when use is made of several flexible elements (Figs. 3 and 4) these elements are arranged in such manner as to constitute a continuous connection between piece **3** and loop **4** or the like. For this purpose, it suffices, for instance, to pass through two series of holes such as A—A and B—B the same flexible element which forms a loop. The various loops thus formed are then connected together so as to form a ring **7** which is engaged in loop **4** and which advantageously replaces the fixation device **8** shown by Figs. 1 and 2.

The system according to the invention will be preferably completed by a safety device connecting the parachute to the belt or harness such a device, designated by reference number **9** being for instance constituted by a strap, as in Figs. 1 and 2, or by a cable as in Figs. 3 and 4.

Whatever be the particular embodiment that is chosen, the operation of the device results sufficiently clearly from the preceding description for making it unnecessary to enter into further explanations.

The device according to the invention has over devices of the same kind such as used up to the present time many advantages the most important of which are the following:

The device according to the invention is very simple to manufacture and in particular much simpler than the braking devices including one or several wedging elements.

My device is considerably quicker to assemble.

It is also very efficient and reliable.

Of course, the flexible element **1** might be made of any material other than a textile.

On the other hand, the apertures **2** of a series of apertures through which extends a flexible element **1** may be located along a line which is not necessarily rectilinear.

GEORGES DREYFUS.

PUBLISHED

JUNE 15, 1943.

BY A. P. C.

G. DREYFUS

SHOCK-ABSORBING DEVICES OF THE FRICTIONAL TYPE

Filed Feb. 28, 1941

Serial No. 381,153

2 Sheets-Sheet 1

Fig.1

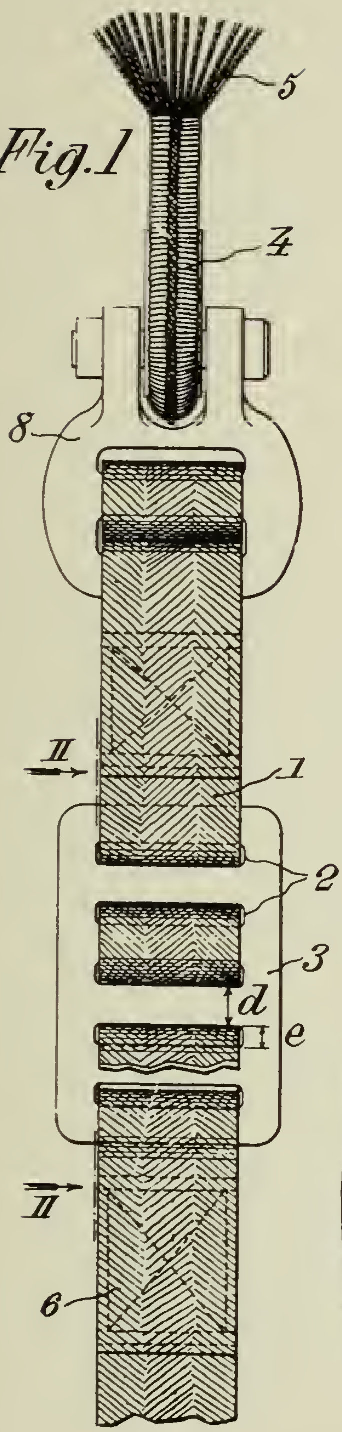
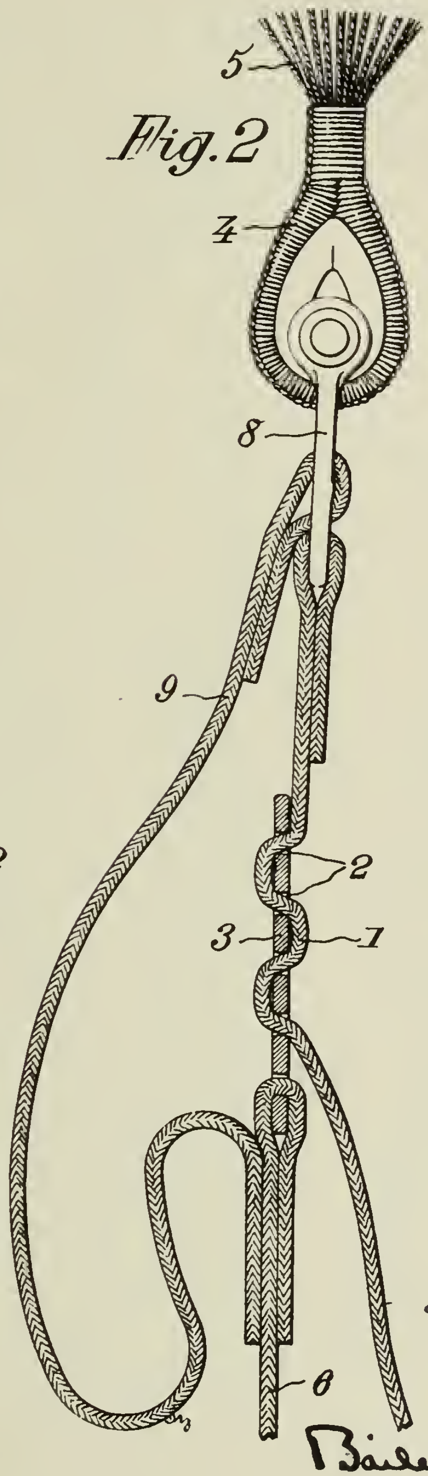


Fig.2



Inventor
GEORGES DREYFUS

Bailey & Larson
Attorneys

PUBLISHED

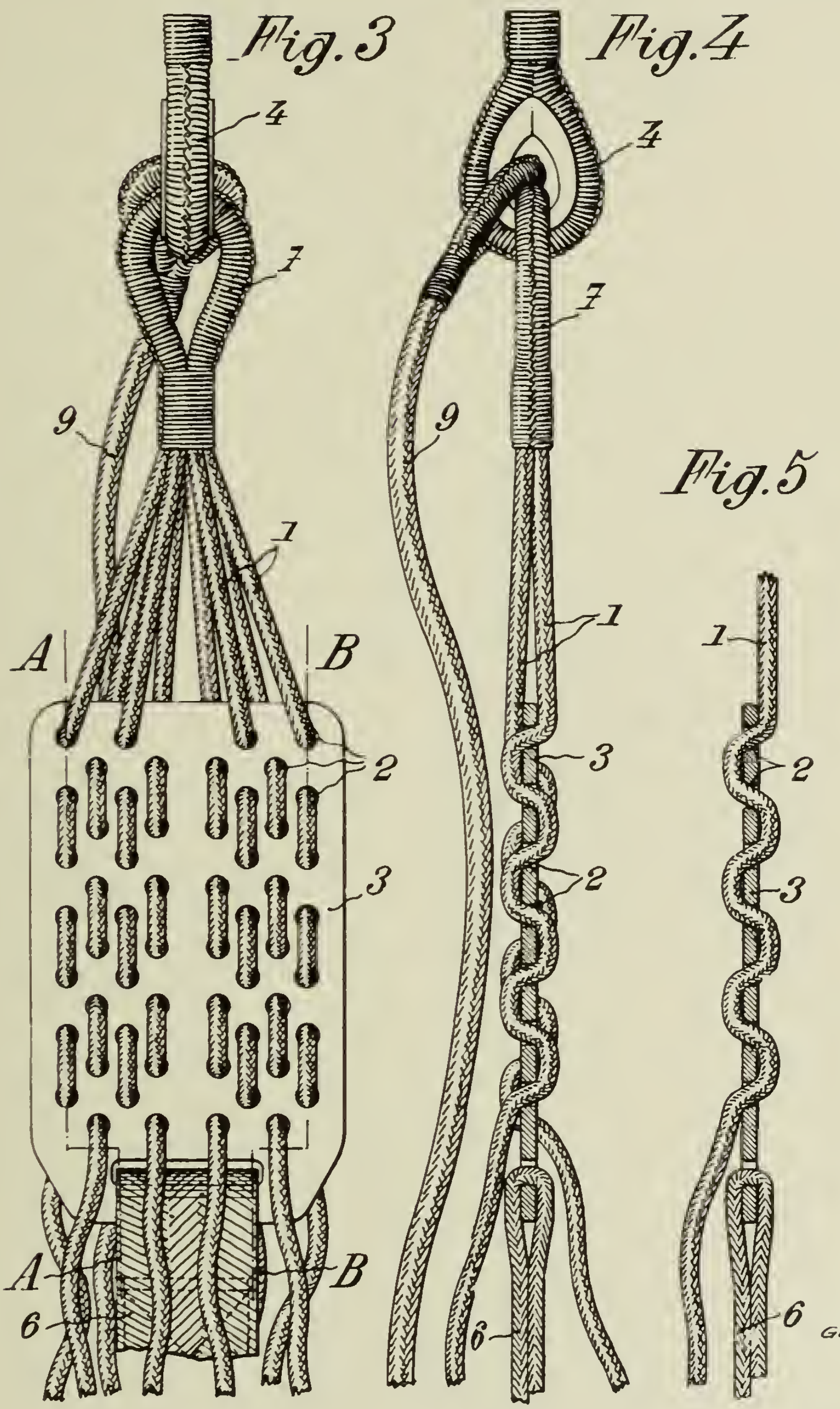
JUNE 15, 1943.

BY A. P. C.

G. DREYFUS
SHOCK-ABSORBING DEVICES OF
THE FRICTIONAL TYPE
Filed Feb. 28, 1941

Serial No.
381,153

2 Sheets-Sheet 2



Inventor
GEORGES DREYFUS,

By Bailey & Larson
Attorney

Published June 15, 1943

Serial No. 381,240

ALIEN PROPERTY CUSTODIAN

LOW-PRESSURE STEAM HEATING PLANT PARTICULARLY ADAPTED FOR RAILWAY VEHICLES

Hans Appel, Prague, Bohemia-Moravia; vested in the Alien Property Custodian

Application filed March 1, 1941

The present invention relates to a low-pressure steam heating provided with a pressure-controlled steam generator plant particularly adapted for railway vehicles. The steam heating plant consists of a heated boiler and an automatically operating device for maintaining the boiler pressure of uniform height within certain limited of regulation. The radiators connected to the boiler are, by means of a distributing pipe, in communication with the steam space of the boiler, so that the same steam pressure prevails in all the radiators as in the boiler, whereby by maintaining the steam pressure uniform simultaneously also the temperature of the heating surfaces of the radiators is controlled. The pressure-controlled steam generating plant on the vehicle, therefore, forms the regulator for the temperature of the heating surfaces of the radiators.

Now, all low-pressure steam heatings of railway vehicles require to be so constructed that they may be operated with steam of a source of high-pressure, preferably steam of a locomotive boiler. Arrangements allowing such an operation are known already.

The known arrangements, however, are not adapted to be used for low-pressure steam heatings of the above described kind, because in such a case high-pressure steam would reach the radiators and the sealing joints would begin to blow. Moreover, the danger of tearing of the radiators would exist. Besides this, the temperature of the heating surfaces of the radiators filled with high-pressure steam would fluctuate in accordance with the steam pressure which would result in an unequal heating of the inner rooms of railway vehicles and, moreover, in a heating plant, operating with a low-pressure boiler provided with a stand-pipe discharging into the atmosphere, the high-pressure steam also would reach the boiler and discharge into the atmosphere by way of the stand-pipe.

Now, the object of the present invention is to so construct the above described low-pressure steam heating that the radiators may be supplied with controlled low-pressure steam from a source of high-pressure steam which is not provided on the vehicle.

According to the invention a thermostatically controlled throttle valve is provided for this purpose in the connecting pipe between the high-pressure steam pipe and the distributing pipe supplying the pressure-controlled steam from the low-pressure steam boiler to the radiators. The thermostat of this throttle valve being influenced by the temperature of the heating medium flowing out of the radiators. If now the low-pressure steam heating is connected to the high-pressure steam pipe, then the high-pressure steam must flow through this automatically operating throttle valve. In accordance with the setting of the thermostat the high-pressure steam is changed to low-pressure steam of quite a definite pressure and now fills the radiators maintaining uniform the temperature of the heating surfaces of same. When heating with steam of a source of high-pressure steam the same working condition of the radiators results as when the heating plant is operated with steam produced in the own pressure-controlled low-pressure steam generator plant.

In the connecting pipe between the high-pressure steam pipe and the above mentioned thermostatically controlled throttle valve an other control member preferably is arranged which by mechanical or electrical means is kept closed as long as the low-pressure steam generator plant operates. Without a special manipulation being required, on starting of the low-pressure steam generator plant simultaneously the connection between the high-pressure steam pipe and the low-pressure steam pipe is directly or indirectly interrupted, so that the radiators are supplied with steam from the pressure-controlled low-pressure steam generator plant only.

In connection with heating plants it is usual to open and close a step member, mounted in the steam supply pipe leading to the radiators, by a temperature feeler subjected to the temperature of the heated room and to so control the temperature of the room. In accordance with the invention the above mentioned control member is used for this purpose in the heating plant previously described when heating with steam of a source of high-pressure steam. To this end the control member is constructed as a magnetic valve and the hand setting device, serving to disconnect the low-pressure steam generator, is used to place in circuit a contact thermometer subjected to the temperature of the heated space which thermometer on reaching a predetermined limit of temperature effects closure of the magnetic valve and stops the supply of steam derived from the source of high-pressure steam.

As during heating with high-pressure steam from the distributing pipe, supplying the throttled steam to the radiators, a portion of the steam, without flowing through the radiators, reaches the low-pressure boiler and the thermostat of the above mentioned throttle valve and may influence the operation of the latter, it is preferable to

arrange in the distributing pipe of the heating plant, between the discharge point of the connecting pipe, supplying the heating plant by way of the throttle valve with controlled steam, and between the low-pressure steam boiler, a stop member which is influenced to be closed by the pressure of the high-pressure steam. If high-pressure steam is supplied to the heating plant, this stop member cuts off the way leading to the low-pressure steam boiler and an undesired admission of steam to the thermostat of the above mentioned throttle valve is rendered impossible.

It is also of advantage to connect the throttle valve and the control member, controlled electromagnetically in most cases and also if used, the last mentioned pressure controlled stop member in a heat conducting manner, so as to have a mutual thawing up effect by heat conduction and heat radiation. As is well known, during frost all such constructional members of the steam generator plant always freeze in. Each of these constructional members, therefore, always is so formed that on being supplied with steam it thaws up again and is rendered capable of operation.

If now all such constructional members present are in a heat conducting manner connected to each other, each contructional member supplied with steam safely thaws up. Hereby the heat also is transmitted to the other constructional members, so that these without steam being supplied to them also thaw up and are rendered capable of operation.

In the accompanying drawing a heating plant according to the invention is diagrammatically shown by way of example.

In this drawing:

Fig. 1 is a diagrammatic view of the entire plant, and

Fig. 2 is a detail view of a change-over switch.

From the zone of the lowest water level of the low-pressure steam boiler 1 of the heating plant according to Fig. 1 the stand-pipe 4, connected to the branch pipe 56, leads upwardly beyond the water level of a highly located tank 24. The boiler 1 is heated by the electric heating element 80. Its pressure is determined by the water column in the stand-pipe 4 which column is controlled by the float 16 in the following manner.

The float 16 influences a change-over switch 45 arranged in the circuit of the magnetic coil of a valve 40 arranged in the water filling pipe system 47, 4 in such a manner that the valve 40 closes as soon as the highest admissible water level in the boiler 1 is reached. From this point of time flowing off of water from the tank 24 by way of the pipe 47 and the standpipe 4 to the boiler 1 is interrupted until the boiler water level has dropped to an admissible lowest height, whereupon the change-over switch 45 is adjusted and the re-filling valve 40 is opened again, so as to allow water to flow to the boiler 1 again by way of the pipe 47 and stand-pipe 4. If the boiler water level has been raised again to the highest admissible height, the change-over switch 45 is again adjusted, so that the magnetic valve 40 closes again, whereupon the operation described is repeated.

In this manner the steam pressure in the boiler 1 as well as in the radiators 19, connected to the boiler 1 by means of the distributing pipe 20, is controlled. The condense water returns from the radiators 19 to the boiler 1 by way of a pipe 48. To aerate the heating plant, a thermostatically controlled valve 50 is provided which is closed as soon as on heating the air in the plant is displaced by the steam and the latter has heated the thermostat of this valve 50.

To assist the described pressure control in the boiler 1, a relay switch 74 is provided in the circuit 75 and 76 of the heating coil 80. The relay coil is arranged in a circuit so controlled by the float 16, that the heating current of the heating element 80 is interrupted as soon as the float 16 has reached the admissible lowest boiler water level, whereas the heating current is cut in again, if after the re-filling operation the water level of the boiler is raised again to the admissible highest level. Therefore, during the re-filling operation the boiler heating is disconnected to faster obtain the re-filling. The boiler heating operates as long only as the water level in the boiler is within the permissible limits.

As mentioned already, the radiators 19 and the steam space of the boiler are always filled with steam of the same pressure and the temperature of the heating surfaces of the radiators is always maintained on the same height. In order to allow the operation of such a heating plant with controlled steam derived from a source of high-pressure steam, preferably steam from a locomotive boiler, as is required in connection with railway vehicles, the main steam pipe 30, extending below the vehicle and carrying the high-pressure steam, is, in accordance with the present invention, connected to the distributing pipe 20 of the low-pressure steam generator plant by way of a connecting pipe 31 in which a throttle valve 60 is arranged. The latter is controlled by a thermostat 61 subjected to the temperature of the heating medium leaving the radiators 19 by way of the pipe 48, whereby the extensions by heat of the thermostat are transmitted by way of a rod 67, the lever 68 and the extension rod 60′ to the valve 60 in such a manner that by way of the pipe 20 always as much steam only flows to the radiators 19, that a predetermined pressure is maintained in these radiators and, therefore, also the temperature of the heating surfaces of said radiators is maintained uniform. If, therefore, the pipe 30 is supplied with high-pressure steam, the radiators 19 are, by means of the steam supplied to them from the source of high-pressure steam, heated in exactly the same controlled manner as by the pressure-controlled steam admitted to them after connecting the low-pressure steam boiler 1.

In the connecting pipe 31 between the thermostatic throttle valve 60 and the high-pressure steam pipe 30 a control member 62, in the example shown a magnetic valve, is arranged, so that after connecting the low-pressure steam boiler 1 the controlled steam supply of the radiators 19 which is then to be effected exclusively from the boiler 1 is not subjected to a disturbance due to steam flowing off into the pipe 30 in which at this point of time no steam is present. In the control circuit of the magnetic valve a switch 70 is arranged which also serves for switching in the control circuit for the boiler filling valve 40. As shown in Fig. 2 this switch has three positions and serves to connect and disconnect the low-pressure steam heating plant. In the O-position all the contacts 9 and 10 are open and the plant is out of service On changing-over into the position I, the contact 9 is closed which cuts in a circuit by way of a blowing out or discharge valve 44 of the boiler 1, so that the heating coil 43 heats the thermostat of the valve 44 and closes the latter so that the boiler 1 may

be filled with water. In the position II the contacts 10 also are closed which by way of the magnetic coil switch in the control-circuit of the re-filling valve 40, so that the latter is opened and allows water to flow from the tank 24 into the boiler 1 until the highest water level is reached and the valve 40 is closed again. By way of the relay switch 74 simultaneously the heating current for the heating element 80 is switched in and the development of steam in the boiler 1 starts. Moreover, the magnetic valve 62 is closed so that the connecting pipe 31 is closed towards the high-pressure steam pipe 30.

With regard to its pressure and the temperature of its heating surfaces, the heating plant now operates in a controlled manner as has been described above.

Putting out of service of the heating plant is effected by turning the switch 70 into the position O. If the heating plant is to be operated with high-pressure steam derived from the pipe 30, the switch 70 is brought into the position I which at first has the purpose only to close the blow out or drain valve 44 so that the condense water flowing by way of the pipe 43 from the radiators 19 to the boiler 1 collects in the latter for the later main operation of the low-pressure steam generator plant.

The magnetic valve 62 is not yet supplied with current and by way of this valve and the connecting pipe 31 the high-pressure steam flows to the throttle valve 60 which reduces the pressure of the high-pressure steam to the desired low-pressure and admits this steam to the radiators 19 by way of the distributing pipe 20. To prevent a portion of the pressure-reduced steam to flow into the boiler 1 and from the latter either to escape by way of the stand-pipe 4 or to advance into the pipe 48 and to heat the thermostat 61 of the throttle valve 60, thereby disturbing the desired throttle operation, a stop member 63 is provided in the distributing pipe 20 between the discharge point of the connecting pipe 31 and the boiler 1.

The stop member 63 is influenced in an opening sense by a spring and is closed by the piston 65, if high-pressure steam is admitted to the latter from the pipe 30 by way of the pipe 64. In this case the radiators 19 are supplied with throttled steam by way of the throttle valve 60 maintaining uniform the temperature of the heating surfaces of the radiators 19.

For the purpose of regulating the room temperature when the heating plant is operated with high-pressure steam derived from the pipe 30, a contact thermometer 71 is provided in the control circuit of the magnetic valve 62 and this thermometer causes the closure of the magnetic valve 62 as soon as the room temperature exceeds the setting temperature of the contact thermometer 71. By an alternate closing and opening of the magnetic valve 62, maintaining uniform height of the room temperature is ensured.

If the heating plant is operated with steam derived from the low-pressure boiler 1 the switch 70 occupies the position II. Hereby the contact thermometer 71 is short-circuited but a contact thermometer 72 is switched in in the circuit containing the change-over switch 45 and the relay coil of the relay switch 74. The contact thermometer 72 also is subjected to the temperature of the heated room and controls the temperature of this room by an alternate opening and closing of the heating circuit 75, 76 of the heating element 80. The current required for all these control operations is supplied by a battery 73, preferably the light battery of the vehicle.

It may easily be seen that the constructional members i. e. the throttle valve 60, the magnetic valve 62 and the stop member 63 may be arranged in a common casing or may otherwise be connected to each other as desired in a heat conducting manner. If after putting the vehicle out of service, all these constructional elements are frozen in and if for instance high-pressure steam is admitted through the pipe 30, the magnetic valve 62 is supplied with steam and thaws up. The heat, however, also is transmitted to the other constructional member 60 and 63 so that these also thaw up and are rendered capable of operation. Putting in service of the low-pressure steam boiler 1 has the same effect but then steam is admitted to the stop member 63 which thaws up, whereupon the heat is transmitted to the constructional members 60 and 62 by conduction and radiation.

HANS APPEL.

[illegible]

PUBLISHED

JUNE 15, 1943.

BY A. P. C.

H. APPEL

LOW-PRESSURE STEAM HEATING PLANT PARTICULARLY ADAPTED FOR RAILWAY VEHICLES

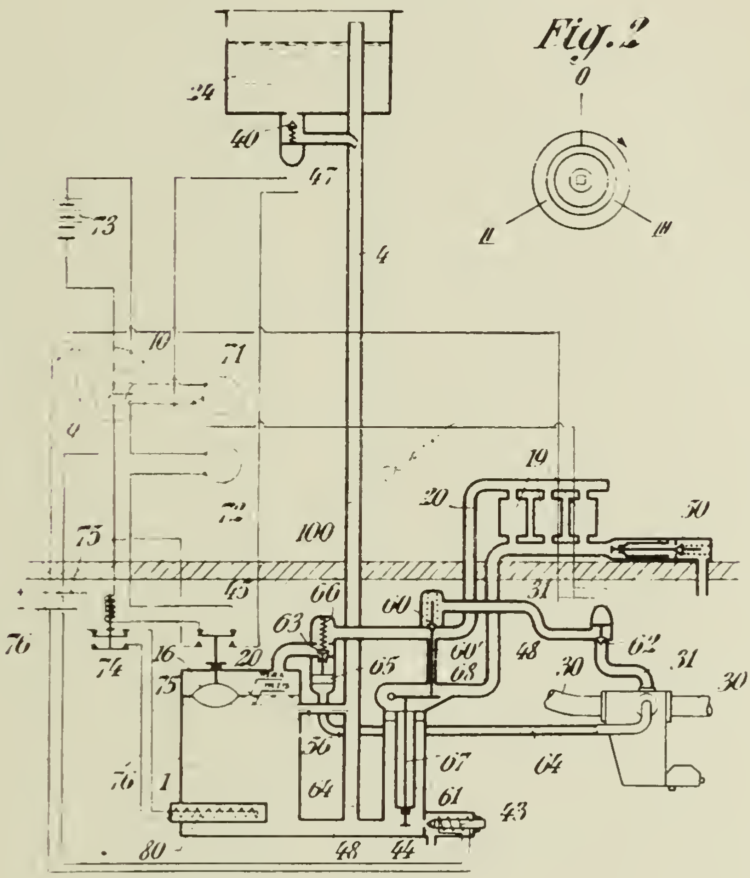
Filed March 1, 1941

Serial No.

381,240

Fig.1

Fig.2



INVENTOR

HANS APPEL

PER Karl A. Mayr

ATTORNEY.

Published June 15, 1943 Serial No. 381,656

ALIEN PROPERTY CUSTODIAN

FREE-PISTON ENGINE WITH OPPOSITELY MOVING MASSES

Franz Neugebauer, Munich-Allach, Germany; vested in the Alien Property Custodian

Application filed March 4, 1941

Free-piston engines having oppositely moving masses and a motor part working according to the two-stroke self-ignition or Diesel system are generally of elongated construction, because their length with a given arrangement and shape of the elements of the engine always equals a certain multiple of the stroke of the motor pistons and the ratio of the length of this stroke to the diameter of the motor cylinder must be ample when in the motor part favorable operating conditions (for instance, as to scavenging, fuel distribution, combustion &c) are aimed at. Furthermore a large stroke of the flying masses involves a relatively small number of strokes per unit of time, and therewith a low limit of efficiency.

As in free-piston engines the length of the stroke is not absolutely fixed, but is subject to certain variations, hereafter an unvariable and easily definable value shall be substituted therefor, that is the distance which the front faces of the motor pistons have from each other when the piston governing the exhaust outlet just opens or closes the outlet ports provided in the cylinder wall. This distance may be called "useful-space length", because it represents the length of the space which contains the motor cylinder charge which is subject to compression and therefore is "useful space".

It is true that free-piston engines of this kind have been described in which the ratio of length of the useful space to the diameter of the motor cylinder is relatively small (down to about $n:d=1.2$); in practice, however, a limit lower than 2.8 was not surpassed, because otherwise the operating conditions in the motor part would have become too unfavorable. For instance, it was ascertained that by decreasing the ratio of n:d the scavenging becomes incomplete inasmuch as exhaust gases remain in the motor cylinder so that only a correspondingly reduced quantity of fuel can be burnt, whereby the efficiency per unit of volume is reduced. Furthermore, as in a short-stroke engine in the inner dead position of the motor-pistons the distance of the piston bottoms from each other is smaller than in a long-stroke engine having the same useful space, in the short-stroke engines a greater part of the fuel to be injected will collect at the piston bottoms and thereby be excluded from the combustion. Therefore it was hitherto for practical reasons necessary to employ a high ratio of n:d and to put up with a relatively small number of strokes per unit of time for such engines

It is true that one has proposed to make the working space of the motor annular instead of cylindrical in order to reduce the length of the useful space and therewith the total length of the engine. However this construction was not adopted in practice, above all for the reason that a motor having an annular working space is quite more difficult to construct than a cylindrical one; further drawbacks consist therein that with an annular working space it is more difficult to obtain an intimate contact of the combustion air with the fuel to be injected, and that the heat-radiating surface of the combustion space is considerably greater than with a full-cylindrical working space.

The object of my invention is to procure a short-stroke free-piston engine having flying masses moving in opposite directions and a simple, full-cylindrical working space of the motor part, but affording favorable operating conditions similar to those of a long-stroke engine.

I have discovered that the practical difficulties hitherto observed in connection with a short-stroke free-piston engine provided with compression ignition and full-cylindrical working space are substantially attributable to the fact that short stroke involves a lower utilization of the air or the oxygen of the air introduced during the scavenging operation into the working space of the motor for the combustion of the fuel. This lowered utilization is characterized on the one hand by a diminished scavenging effect, inasmuch as a relatively great amount of exhaust gases and a correspondingly reduced amount of air remain in the motor working space, and on the other hand by an increase of the excess of combustion air, as a greater portion of the air left behind in the motor working space not participates in the combustion step.

Means are well known (or have been proposed) to increase the utilization of the air supplied to the motor working space during the scavenging operation for the combustion of fuel. For instance, it is old to improve the scavenging quality in crank motors by arranging the ports provided in the wall of the working cylinder in such a manner that the passing jets of scavenging air flow in different directions, part of the jets being radially directed so that these jets meet near the cylinder axis and then united continue flowing in the middle of the cylinder thereby scavenging the core of waste gas, whereas the other jets of scavenging air flow more tangentially and are in certain cases more or less inclined toward the cylinder axis, thereby producing a helical

whirling flow surrounding the central flow. With this kind of scavenging—in contradistinction to the usual pure whirly scavenging which with short-stroke motors as proved by experiments results in a bad core scavenging—even with short-stroke engines complete scavenging of the waste gasses is obtained. At the same time the advantage of the pure whirl-scavenging is preserved, to wit the production of an air circulation continuing during the compression and injection of fuel, whereby the contact of the air with the injected fuel is favored.

For free-piston engines with a motor part working with two-stroke and compression ignition one has proposed to supply at least a notable part of the fuel to be introduced already before the self-ignition temperature is reached, so that up to the moment of self-ignition a mixture of air and unburnt fuel is compressed. In this case a longer period for approaching the air to the fuel is available than with the usual injection taking place after the self-ignition temperature has been reached; moreover the danger of the greater part of the fuel to be injected getting to the bottoms of the pistons is avoided, because the latter have yet a considerable distance from each other. In this case it is even possible to arrange the supply of fuel to be adjusted so that the cloud of fuel particles formed of the injected atomized fuel extends in the direction of the cylinder axis at both sides and considerably beyond the dead space, and in this way to bring as far as possible the whole of the combustion air early (before the beginning of the compression) into intimate contact with the fuel. These measures therefore enable the excess of combustion air required for complete combustion to be diminished, i. e. to completely burn more fuel than heretofore with the same charge of air and thereby to correspondingly increase the effect of the machine.

Furthermore it is favorable for the diminution of the excess of air to introduce the fuel into the air charge at different points distributed, in the well known manner, over the combustion space.

Correspondingly the inventor proposes to use short strokes in the motor part of a free piston engine, working according to the two-stroke self-ignition (Diesel) system and having the usual full-cylindrical working space, i. e. to construct the motor part in such a manner that the ratio of the "useful-space length" to the diameter is about equal to or less than 2, and at the same time to provide means of the above-mentioned kind which permit of a better utilization of the air, introduced into the working space of the motor during the scavenging operation, for the combustion of fuel. Such means may be employed either singly or in combination with one another.

In this way the motor part of the free-piston engine operates under similar favorable conditions as that of a long-stroke engine. Moreover it affords, as compared with the latter the advantage of a reduced length and a higher efficiency due to the higher number of strokes.

The invention will now be more fully explained at the hand of the annexed drawings of which

Fig. 1 is a longitudinal central cross-section of a free-piston engine, the oppositely moving flying masses of the engine being in the position in which the motor piston controlling the air outlet ports provided in the wall of the motor cylinder just opens or closes;

Figs. 2 and 3 show cross-sections through the fresh gas inlet ports on the lines II—II and III—III of Fig. 1 respectively;

Fig. 4 shows in side elevation the flying masses of the engine together with their coupling gearing in the same position as in Fig. 1, and the fuel pump together with its drive in cross-section;

Fig. 5 is a cross-sectional view of the motor part of the engine during the inward stroke of the motor pistons.

Fig. 6 is a cross-section of the dead space on the line VI—VI of Fig. 5 and

Fig. 7 shows a similar cross-section with the arrangement of a plurality of injection nozzles.

The engine shown in Fig. 1 comprises a motor cylinder 1 and compression cylinders 2, 3 joined with its ends. In the motor cylinder do operate the motor pistons 4, 5, in the compression cylinders the compression pistons 6, 7, the latter dividing the compression cylinders 2, 3 into the two compartments, viz. the outer compression compartments 8, 9 and the compartments 10, 11 turned toward the motor cylinder 1 and serving as scavenging pump in the present example. The compression compartments 8, 9 are provided with suction valves 12 and non-return valves 13, the latter being located in chambers to which are joined the pressure pipes 14 for conducting away the compressed gas. The scavenging pump compartments 10, 11 are provided with suction valves 15 and non-return valves 16. The latter allow the conveyed scavenging air to enter a scavenging air receiver 17 surrounding the motor cylinder. In the wall of the motor cylinder 1 at one side near the end of the working space scavenging ports 21, 22 are provided which are arranged in two circumferential rows succeeding each other in axial direction and communicating directly with the receiver 17. At the other side of the working space outlet ports 23 are provided in the wall of the motor cylinder near the other end of the working space, which ports communicate with a collecting space 24 to which the exhaust pipe 25 is joined. Liquid fuel is supplied to the motor cylinder through an injector nozzle 26 arranged on the dead space to which the liquid fuel is supplied under high pressure by means of an injection pump over the compression pipe 27. The flying masses formed by the pistons 4 and 6 on the one hand and the pistons 5 and 7 on the other hand are connected by a coupling gear (shown in dotted lines) in such a manner that they always perform corresponding opposite movements. For this purpose racks 31 and 32 are connected with each of the flying masses respectively. These racks engage at diametrically opposed points a pinion 33 journaled on a trunnion fixed in the motor cylinder frame. In the example shown the dimensions of the engine are chosen in such a manner that in the shown position of the pistons in which the motor piston 5 controlling the exhaust just opens or closes the outlet ports 23, the distance n between the front faces 35, 36 of the pistons (the "useful space length") is equal to the double diameter d of the motor cylinder, the ratio being

$$n:d=2$$

Now, in order to obtain the best possible utilization of the combustion air supplied to the motor cylinder for scavenging, in spite of this extraordinarily small ratio unfavorable to the self-ignition method with the usual configuration of the motor part, the fresh gas inlet ports are shaped in an especial manner. As already mentioned, two circumferential rows of such scavenging ports are arranged to succeed each other in axial direction. The ports 21 of the cir-

cumferential row which is more remote from the combustion space are formed in such a manner that the air jets passing through in the scavenging operation are vertically directed to the cylinder axis. These air jets (arrows *a*) impinge upon one another in the center of the cylinder and are then deflected toward the combustion space in the direction of the cylinder axis so that they transverse substantially the central portion of the cylinder, thereby shifting the core of waste gases outwardly. The ports **22** of the other circumferential row which is nearer to the combustion space are formed in such a manner that the passing air jets, as shown in Fig. 3, are directed more tangentially; furthermore these ports are inclined to the cylinder axis so that these air jets are simultaneously directed obliquely to the combustion space as shown by the arrows *b* and *c* (Fig. 1). This oblique direction differs in the single ports; for instance, ports of weaker inclination (arrow *b*) may alternate with ports of stronger inclination (arrow *c*). The ports may also have more than two different degrees of inclination, the ports having the same inclination being preferably uniformly distributed over the periphery. Furthermore also several circumferential rows of ports may be provided (as known per se) which produce jets deviating from the radial direction and directed obliquely towards the combustion space in such a manner that this deviation from the radial direction and the obliqueness are the more increased the nearer the circumferential row comes to the combustion space. The air streaming in through this circumferential row or rows traverses the cylinder, as indicated by the prolonged arrows *b* and *c* in helical direction and produces a strong air whirl lasting even after the inlet ports have been closed by the working piston which whirl is favorable for approaching the air to the fuel to be introduced into the combustion space. By combining this whirling scavenging with the core scavenging a quite perfect scavenging of the waste gases out of the motor cylinder is obtained, in spite of the unfavorable ratio of $n:d$, and the motor cylinder is filled with fresh air, so that a greater quantity of fuel can be burnt than with the usual form of the scavenging ports which with this small ratio of $n:d$ would result in an incomplete scavenging because especially the core of waste gases would be only incompletely removed. By the combination of the small ratio of $n:d$ with the scavenging device producing a whirl of air and simultaneously warranting the scavenging of the core of waste gases the short-stroke free piston engine becomes, as regards the scavenging, wholly equivalent to the long-stroke engine.

Fig. 4 shows a fuel supplying device which enables at least a considerable part of the fuel burnt per each working stroke to be introduced into the working cylinder before the cylinder charge has attained the self-ignition temperature of the fuel. The pump **40** conveying the liquid fuel to the injection nozzle **26** is in the well known manner driven by a cam **41** rigidly connected with one of the racks (f. i. **31**) of the coupling gear **31** to **33**. Whereas this cam is usually so formed that it drives the pump piston **42** in a conveying stroke only when the motor pistons approach their inner dead position, that is when the air enclosed between them has already reached the self-ignition temperature of the fuel, in the instant case the cam is so formed that with full load of the engine the conveying stroke of the pump piston **42** is initiated early, for instance, already when the outlet ports **23** are closed by the motor piston **4**. For this purpose the sloping part **43** of the cam **41** on which runs the roll **44** of the swing-arm **45** driving the pump piston **42** is so formed that it just begins to lift the pump piston when the piston is in the abovesaid position. The inclination of the sloping part of the cam is so small that the injection is extended over a considerable part of the inward stroke of the piston. The ignition of the injected fuel takes place only after the self-ignition temperature is reached. This method of supplying fuel which with crank engines would be inadmissible because of the excessive ascent of pressure taking place therein, can be employed without scruple in free piston engines working with free swinging masses because the energy effecting the compression of the motor cylinder charge is limited as to amplitude so that with rapidly increasing resistance, provoked by the increase of the pressure due to the combustion of the injected fuel, the energy is soon consumed, and because flying masses under this increasing pressure rapidly reverse their direction of motion, whereby the pressure is again rapidly decreased, so that an excessive increase of pressure cannot take place. On the other hand an advantage is attained inasmuch as now substantially more time is available for approaching the combustion air to the fuel than with the usual supply of the fuel taking place after the self-ignition temperature is reached, and consequently the combustion is a much more complete one, that is that more fuel can be completely burnt with the same air charge than heretofore. This injection method itself constributes to substantially increasing the utilization of the air charge foı combustion which otherwise is bad in short-stroke free piston engines.

Especially advantageous is the combination of this method of fuel injection with the above described scavenging method (united whirl- and core scavenging).

The above-mentioned especial method of supplying fuel enables a further improvement in approaching the combustion air to the atomized fuel supplied into the combustion space. In the beginning of the fuel supply the front faces **35**, **36** of the motor pistons **4**, **5** are placed at a relatively great distance from each other. The fuel may therefore be introduced into the combustion space in such a manner that the cloud consisting of minute particles of fuel extends at both sides in the direction of the cylinder axis beyond the dead space, without risking that a considerable part of the injected fuel attains the bottoms of the pistons and then is incompletely burnt. Hereby the air space comprised between these bottoms, which is yet great at the beginning of the injection, is thoroughly interspersed with fuel, and the combustion air is perfectly approached to the fuel even if the usual whirl-scavenging is not employed.

An engine provided with a fuel injection of this kind is shown in Figs. 5 and 6. The fuel is here introduced into the working space of the motor by means of the nozzle **26** in the form of a fan, the plane of this fan extending in the direction of the axis of the working cylinder, and this fan extending at both sides far beyond the inner dead position of the front faces **35**, **36** of the pistons indicated by the dotted lines t_1, that is beyond the borders of the dead space,

without incurring the risk of greater amounts of fuel adhering to the bottoms of the pistons.

With the usual, as well as with the described especial method of supplying fuel it is further advantageous to provide several supply points distributed over the combustion space. Fig. 7 shows by way of example three injection nozzles 27 uniformly distributed over the periphery of the dead space. The jets or fans of fuel may have in this case a direction deviating from the radial one, i. e. a more tangential direction in order to be as independent from one another as possible and to intersperse with fuel the air charge as uniformly as possible.

FRANZ NEUGEBAUER.

PUBLISHED

JUNE 15, 1943.

BY A. P. C.

F. NEUGEBAUER

FREE-PISTON ENGINE WITH OPPOSITELY MOVING MASSES

Filed March 4, 1941

Serial No. 381,656

Fig.1

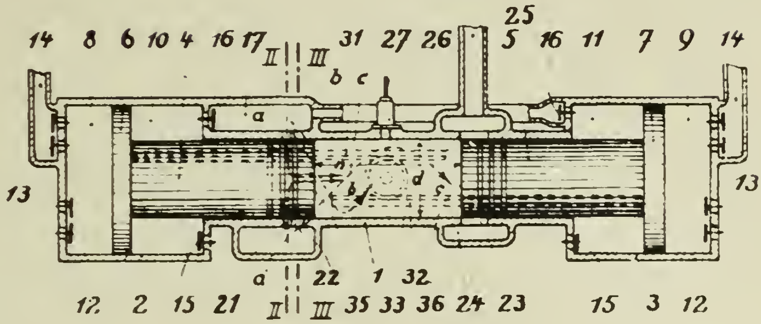


Fig.2

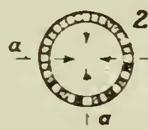


Fig.3

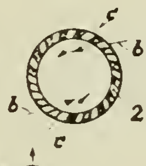


Fig.4

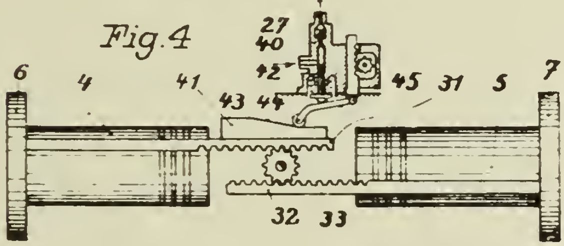


Fig.5

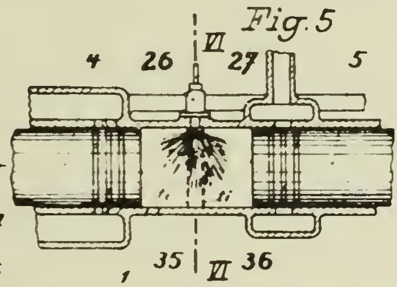


Fig.6

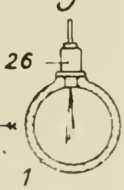
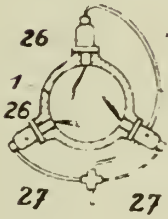


Fig 7



Published June 15, 1943

Serial No. 381,739

ALIEN PROPERTY CUSTODIAN

RESILIENT TUBULAR BODIES

Friedrich Tölke, Berlin-Charlottenburg, Germany; vested in the Alien Property Custodian

Application filed March 4, 1941

This invention relates to resilient tubular bodies or bellows of the type used in expansion pipes, compensators, spring bodies, elastic pressure cushions, stuffing boxes for shafts, pressure regulators, pressure reducers and the like.

It is an important object of the present invention to provide annular bellow elements of a shape withstanding high pressure of the medium within the bellow, with relatively small wall thickness of the ring elements.

With this and further objects in view, as may become apparent from the within disclosures, the invention consists not only in the structures herein pointed out and illustrated by the drawings, but includes further structures coming within the scope of what hereinafter may be claimed.

The character of the invention, however, may be best understood by reference to certain of its structural forms, as illustrated by the accompanying drawings in which:

Figs. 1 and 2 are fragmentary sections of two types of bellows having the invention applied thereto.

Fig. 3 is a diagrammatic section indicating the manner in which the shape of the bellow elements may be ascertained by computation.

Fig. 4 is a diagrammatic fragmentary section indicating two possible forms of tubular connecting members between the bulbous bellow elements, and

Fig. 5 is a diagram illustrating the optimum ratio of wall thickness of the pipe to thickness of the ring elements in dependence of the ratio of pipe diameter to ring diameter.

Similar characters of reference denote similar parts in the different figures.

Broadly speaking, the present invention contemplates the provision of bulbous collars for the expansion elements of the bellow which are so shaped that the strain therein owing to the interior pressure is substantially the same on all points and in any section of the collar.

Referring now to the drawings in greater detail, and first to Figs. 1 and 2, it will be noted that the resilient collar portions of the elastic tubular body consists of two shell members or annular disks **11**, **12**, or **11'**, **12'**, resp., which are welded together at **13**, and moreover are welded to the pipe ends **15** at **14**. The shell portions are so shaped that in case of inner pressure acting within the pipe the stresses set up in the shells are pure longitudinal stresses (i. e. no transverse stresses), and normally tension stresses only, while pressure stresses which might cause bending or bumps cannot occur. Thus, the duration of life of the resilient body which is greatly reduced in the known forms of resilient tubular bodies by bending and bumping phenomenons, especially at high pressure, is considerably increased.

Fundamentally, the shell portions to this end are shaped in such a manner that their interior curvature is concave throughout, without any portions having a convex inner curvature or a non-curved, straight form over a finite length. Preferably, I use a shape defined by a so-called nodoid surface (refer, e. g., Auerbach-Hort, Handbuch der Physikalischen und Technischen Mechanik, vol. VII, pp. 46–48) which depending on its use may be applied in its original shape, as shown in Fig. 1, or in a shape which is distorted by affinity or otherwise, as shown in Fig. 2. A special advantage of the nodoid surface consists in the fact that the radii of curvature of its generating or cross sectional curve are decreasing continuously from its outer part towards its inner part, i. e., as shown in Fig. 3, $r_1>r_2>r_3$, whereby a shell of uniform strength is produced. Where a distorted nodoid surface is used, as per Fig. 2, its generating curve may be shaped so that at least a negative or concave curvature is ensured on all points. In other words, the generating curve or cross sectional line of the shells should be curved in only one direction throughout, avoiding any points of inflection or straight portions.

In order to avoid tensions or strains due to different elongations of the tubular portions **15** and the shell portions at the welds **14**, I have computed the optimum proportions of pipe thickness to shell thickness in dependence of the ratio of pipe diameter to shell diameter. The straight lines shown in Fig. 5 define the region of dependence which is formed by the four straight lines *a*, *b*, *c*, *d*, whose formulae are put hereunder, viz:

$$\left.\begin{aligned}(a)\quad \frac{h_R}{h}&=9{,}5\,\frac{D_i}{D_a}-2{,}2\\ (b)\quad \frac{h_R}{h}&=9{,}5\,\frac{D_i}{D_a}-0{,}6\end{aligned}\right\}\text{up to } \frac{D_i}{D_a}=\text{about } 0{,}6$$

in which

$$\left.\begin{aligned}(c)\quad \frac{h_R}{h}&=32\,\frac{D_i}{D_a}-17\\ (d)\quad \frac{h_R}{h}&=32\,\frac{D_i}{D_a}-13\end{aligned}\right\}\text{upwards of } \frac{D_i}{D_a}=\text{about } 0{,}6;$$

in which

h_R=wall thickness of tube
h=wall thickness of shells
D_i=tube diameter
D_a=diameter of shells,

as shown in Fig. 3.

The above mentioned definition gives a very reliable welded connection between tube **15** and shells **11**, **12**, or **11'**, **12'**, preventing the welds **14** (Figs. 1 and 2) from tearing. The tubular connecting member **15** between the adjacent shells may be formed in any desired manner, for ex-

ample, cylindrically, as indicated at 16 in Fig. 4, or with an inward curvature, as indicated at 17 in Fig. 4.

The method and apparatus of the present invention have been described in detail with reference to specific embodiments. It is to be understood, however, that the invention is not limited by such specific reference but is broader in scope and capable of other embodiments than those specifically described and illustrated in the drawings.

FRIEDRICH TÖLKE.

PUBLISHED

JUNE 15, 1943.

BY A. P. C.

F. TOLKE

RESILIENT TUBULAR BODIES

Filed March 4, 1941

Serial No.

381,739

2 Sheets--Sheet 1

Fig. 1

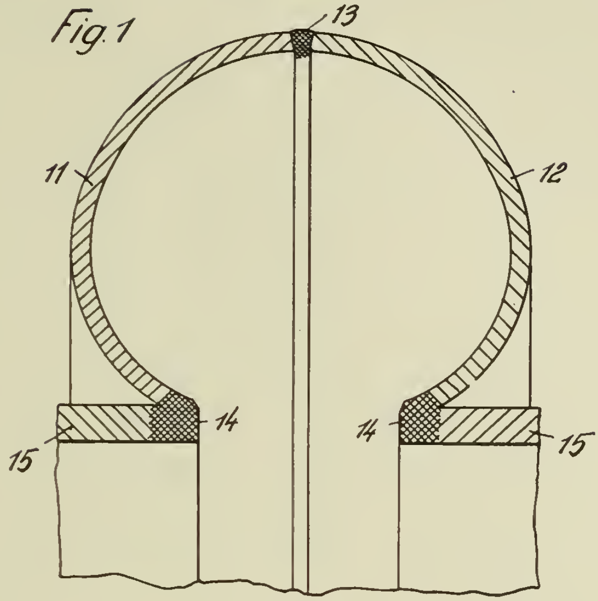
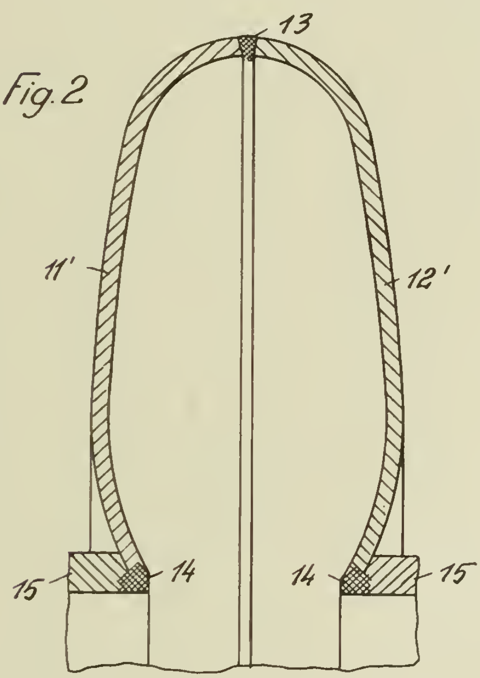


Fig. 2



Inventor:
Friedrich Tölke,
By John B. Brady
Attorney

PUBLISHED

JUNE 15, 1943.

BY A. P. C.

F. TÖLKE

RESILIENT TUBULAR BODIES

Filed March 4, 1941

Serial No.

381,739

2 Sheets-Sheet 2

Fig. 3

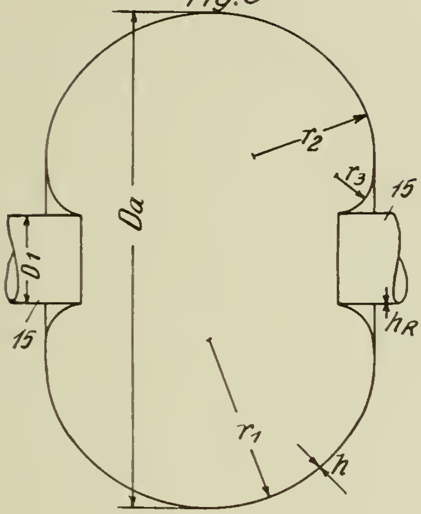


Fig. 4

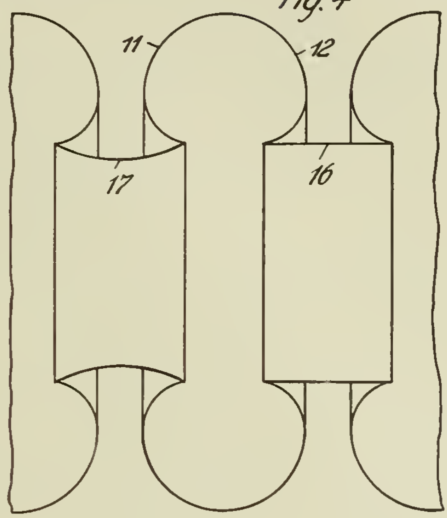
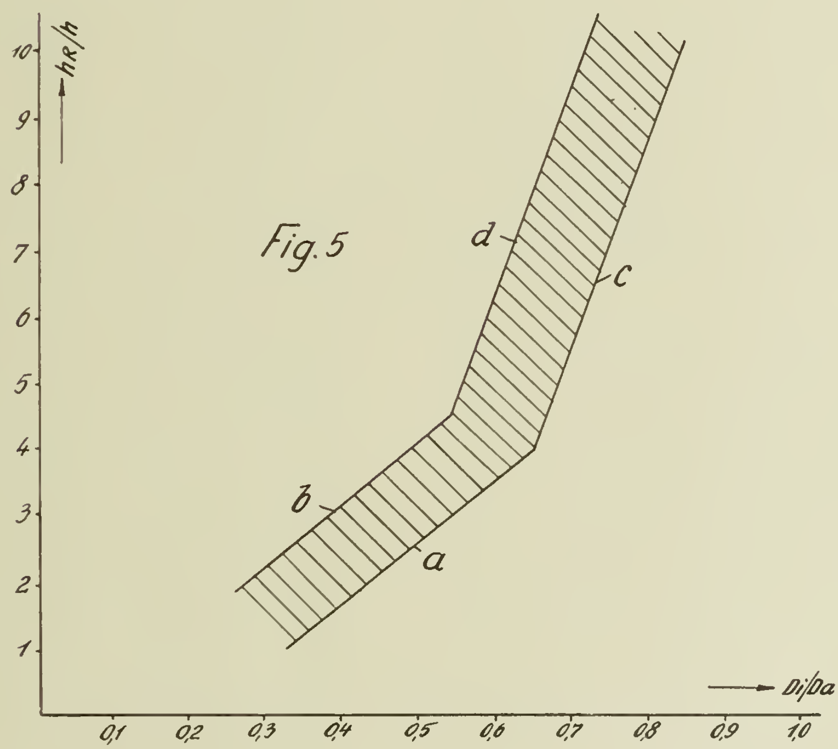


Fig. 5



Inventor:
Friedrich Tölke,
by John B. Brady
Attorney

ALIEN PROPERTY CUSTODIAN

MOLDS

Ernest Mayer, Leipzig, Germany; vested in the Alien Property Custodian

Application filed April 8, 1941

This invention relates to a mold for air-cooled ribbed cylinders, cylinder heads, or similar ribbed work.

It has been the prevailing practice hitherto to cast objects of this class in two-part molds produced with the aid of patterns. The production of such molds is, however, quite bothersome, protracted and difficult and requires a skilled molder. Furthermore, as the narrow gaps between the ribs of the pattern prohibit tamping down of the molding sand the latter must be loosely thrown in, and the riblike mold parts have to be fitted with a large number of pins which often get out of line and have to be knocked out during cleaning whereby the casting may be damaged. The use of an ordinary mold involves, moreover, the drawback that a cylinder cast therein has a seam running around it and its appearance is as a rule not satisfactory. The half ribs are usually displaced relative to each other at the seams, and the casting is seldom accurate to size, because the pattern cannot be smoothly removed from the mold, particularly if the ribs are closely arranged and possess a slight wall thickness to insure effective cooling. Special difficulties have also to be overcome at present in cleaning a casting fitted with closely adjacent thin ribs which break off easily, so that relatively much waste occurs. The necessity of getting the pattern out of the mold restricts the possibilities of shaping the part to be cast, and for this reason the shape and arrangement most favorable for instance to cooling must often be sacrificed.

It is known to employ in the casting of cylinder heads provided with cooling ribs and intended for air-cooled engines a mold built up from superposed metallic core plates each pair of which forms the mold part corresponding to a rib and which are divided in axial direction of the cylinder, so that, owing to this longitudinal division, they can be withdrawn from the finished casting. A mold of this type, however, does not permit good shrinking of the casting and leaves therein a seam extending over the entire axial section. As the core plates have to be drawn out laterally, shaping of the ribs is restricted to a smooth form tapering off towards the outer edge, and during the removal of the plates, which must be done while the casting is still semiplastic, either the ribs or the casting is easily damaged.

Compared with the known art, the invention resides in providing for a mold of the type mentioned comprising flat superposed plates of which two adjacent ones form the mold part corresponding to a rib core members produced in the sand as undivided plates in consequence whereof the casting can shrink without impediments and has no seam. Apart from the very simple rib patterns required for the production of the core plates, no pattern for the casting is needed and the drawbacks connected with casting to pattern are eliminated. As the cores drop out by themselves and smooth surfaces are obtained, cleaning is greatly facilitated and often superfluous. Any desired shape may furthermore be imparted to the rib and casting, which is particularly suited for cooling, such as a cruciform, wavelike, etc. shape. The production of the mold requires only a few simple core boxes, core pins can be dispensed with entirely and in producing the mold parts limiting the hollow rib spaces the sand may be stamped in the usual manner. There is moreover no seam, since the parting lines coincide with the edges of the ribs. The manufacture of the mold is considerably speeded up, because the platelike core members can be produced by unskilled female operators and the building up of the mold from the plates does not offer any difficulties.

The platelike construction of the mold for an air-cooled engine cylinder or cylinder head provides moreover surprising possibilities for shaping the cooling ribs in an advantageous manner. For example, the ribs may be provided with reinforcing connecting flanges which may be formed also of metal bars inserted in the core plates. Other advantages afforded by a mold according to the invention comprise the saving effected in sand and the elimination of molding pins. The invention further permits the manufacture of the core plates from iron borings or from a mixture of iron borings and sand instead of from pure sand so as to vary at will the hardness, grain and smoothness of the casting. If the core plates are made entirely from iron borings the cast material will resemble a chilled casting.

According to the invention the sand core plates are further inserted in iron or metal holding means or produced in annular or platelike iron or metal holders whose outer circumference exactly corresponds to the hollow section of the molding box. The metal plates, which may be repeatedly used, insure good fitting and accurate guiding of the core plates in the molding box as well as the proper thickness of the latter, of the hollow molds for the ribs and of the ribs of the casting to be made.

In numerous instances the sand core plates each of which is set in a metal plate may be used

without molding boxes, in which case the metal holding means constitute the box and the superposed plates need merely be secured in relative position. If intricate castings, as cylinder heads for air-cooled aircraft engines, are concerned whose ribs have different contours and are differently positioned relative to one another the core plates are combined into a mold in a one-part or multiple-part flask, the flask or its parts like the core plates or their metal holding means being provided with means, as projections, etc., for alining and supporting the core plates.

The invention makes it possible to cast two or more cylinders on top of each other in a single molding box and thereby to save an upper and a lower core which serve for holding the gate and the core for the bore.

The mold according to the invention may be used also for connecting by casting the ribs made by a separate process with the cylinder liner cast in the mold. To this end the ribs are inserted in the hollow spaces formed by two adjacent core plates in such manner that the inner edges project into the hollow mold space serving for forming the liner and during pouring of the metal are surrounded thereby. The mold may be employed also for casting the ribs around a finished liner to which they are secured by shrinking during cooling of the metal, the liner being inserted as core in the mold.

Other objects of the invention refer to details of construction, arrangement and production of the core plates limiting the hollow rib spaces, and to the effects resulting therefrom, as described in the specification.

The invention is illustrated by way of example in the accompanying drawing, in which

Figures 1 and 2 show a cylinder mold according to the invention, Fig. 1 being a vertical partial section in the direction of the cylinder axis and Fig. 2 a cross section on the line 2—2, of Fig. 1;

Figs. 3 and 4 show a mold according to the invention with inserted metal ribs, Fig. 3 being a partial section through the cylinder axis and Fig. 4 a cross section on the line 4—4, of Fig. 3;

Fig. 5 is an axial section of a mold for casting a cylinder head; and

Figs. 6 to 17 are detail views, partly in elevation and partly in section, of the construction and arrangement of core plates.

Figs. 1 to 4 show a mold in which in a cylindrical molding box 1 a number of platelike core members 3 are superposed on a core 2. The core members 3 are each made from sand in an annular metal plate 8 and with the aid of these plates whose circumferential shape is accurately adapted to the hollow section of the box 1 inserted in the latter. To prevent turning the core plates 3 possess at one point of their circumference a flat portion 4 corresponding to a ledgelike axially parallel reinforcement 5 on the inside of the box 1, which has the same cross-sectional form as the flat portions of the plates, whose inner edge and side faces are so constructed that two adjacent plates always limit a hollow space 6 required for forming a casting rib, as indicated in Fig. 1.

At a slight distance from their outer edge the hollow spaces 6 are connected by openings 7 of the core plates 3, which serve for forming the connecting and reinforcing members between the ribs of the casting. These members may also be formed by bars of suitable material which are inserted in the openings 7.

In the construction shown in Figs. 3 and 4 the hollow spaces serving for forming the ribs and limited by two core plates 3 are provided with inserted flat annular plates 9 whose outline and cross-sectional form exactly correspond to the shape of the ribs of the casting and which possess at their inner edge a projection 10 of dovetailed cross section, which extends into the hollow space 11 of the mold intended for forming the cylinder wall. During the casting operation the projections 10 are embedded in, or welded to, the cast metal of the cylinder wall.

The mold shown in Fig. 5 serves for a cylinder head having differently formed ribs which partly wholly or partially surround the cylinder in planes extending vertically to the cylinder axis and partly extend parallel to this axis, and comprises a molding box 12 shown undivided in Fig. 5, though it may be made up also of two or more parts united by screws. In the box 12 sand cores 13 for forming the hollow spaces for the casing receiving the valve control mechanism are inserted, and between these core members core plates 14 are arranged in upright position on the bottoms of the box 12, two of said plates always forming the hollow molds 15 for the axially parallel extending cooling ribs. Each sand core plate 14 is firmly united with a metal plate 16 whose outline coincides with that of the alining means of the box 12 and whose thickness generally corresponds to the thickness of the cast rib on the outer edge thereof.

As indicated in Figs. 6 and 7, the sand core plates 14 are produced on a flat side of the metal plate 16. The sand core is firmly connected with the metal plate 16 by means of openings 17, 18 which are formed in the plate and may also be undercut to insure better anchoring of the sand, and of undercut projections 19 on the flat side where the sand core plate is formed, whose height together with the thickness of the plate 16 is equal to the spacing of the ribs plus the thickness thereof. The portion of the sand core plate 14 freely projecting beyond the inner edge of the metal plate 16 is preferably reinforced by radially disposed small metal plates 20 whose ends overlap the plate 16 and are provided with openings 21 and edge clearances 22.

For making the sand core plate 14 a pattern is used comprising a base plate which is flat as a rule and on which the rib pattern is secured. The base plate is fitted with a lining stops for arranging thereon and alining the metal plate 16 which is placed on the base plate. In the mold thus formed the core plate is produced in known manner from white core sand with the aid of a plate or if necessary of a second pattern molding the top side of the core plate and after separation from the pattern united with the metal plate 16.

As indicated by dashes and dots in Figs. 6 and 7, the sand core parts projecting from the metal plate 16 can be supported relative to one another after assembling in the mold by means of projections 23 of rib thickness which are positioned on the sides thereof and produce holes in the cast ribs. The provision of projections 23 for supporting the projecting portions of the sand core plates 14 in the mold makes it possible in some instances to dispense with the metal insertions 20.

The pairs of core plates 14, 16 between the sand cores 13 have the same shape and are symmetrically arranged on both sides of a central rib, or of a hollow mold serving for forming it, whose thickness and form of edge are determined by a steel plate 24 inserted between the two adjoining core plates.

On the cores 13, or on the receiving ledges or

projections provided on the insides of the walls of the molding box, sand core plates **25** are placed forming in pairs the hollow molds **26** of cast ribs which extend in planes disposed vertically to the cylinder axis and which meet at an angle the previously mentioned axially parallelly extending ribs. The core plates **25** are formed like the core plates **14**, **16**.

On the set of core plates **25** extending up to the surface of the molding box another set of core plates **27** is piled which form the hollow molds **28** of ribs extending in planes disposed vertically to the cylinder axis. On alining pins **29** inserted in a flange **30** of the molding box **12** the core plates **27** are placed with the openings provided in their metal plates **31**, **31'**, and on the plates **27** a plate **32** is put which receives the mold top, not shown, holds the core **33** for the bore and is fitted with the usual gate and risers.

The metal plates **31**, **31'** are so arranged in pairs within one another that the lower plate **31'** of each pair possesses on the outer edge an upwardly directed annular projection 31^2, and in the flat depression thus formed on the upper side of the plate **31'** the other plate **31** is inserted. As the height of the projection 31^2 of the plate **31'** is somewhat less than the thickness of the inserted plate **31**. a small interstice through which gas and air can escape from the core plates exists between the top of the projection 31^2 and the underside of the next plate fitted with a projection. Otherwise, the core plates composed of the metal plates **31**, **31'** and the sand cores **27** are similarly arranged and produced as the previously described core plates made up from the metal plates **16** ahd the sand core plates **14** which are positioned parallel to the cylinder axis. The joining of the metal plates **31**, **31'** in pairs is advisable when the ribs have a small wall thickness and are slightly spaced to prevent distortion and deformation of the core plates whereby the accuracy to size of the casting would be affected. The arrangement described protects both plates, one by reinforcement of the edge and the other by being inserted in the first, against deformation.

In the construction shown in Figs. 8 and 9 the sand cores **34** are anchored in their metal plates **35** by means of a groove **36** and of additional clearances **37** provided on the inner edge of the metal plates and fitted with reinforcements in the form of thin perforated metal plates. In the embodiment shown these reinforcements are constructed as ring sector plates **38** which when disposed on an outer side of the platelike sand cores **34** serve also for chilling the cast metal.

The construction of the core plate shown in Figs. 10 and 11 differs from the one just described only in so far as the reinforcements **39** are arranged so as to reinforce the inner edge of the sand core plate.

Further reinforcement of the thin-walled core plate is attained according to the invention by coating the finished and baked plate with linseed oil, dextrine, a sugar solution, colophony or similar hardenable substances.

To insure accuracy to size of the casting in axial direction in spite of any possible deformation or wear of the metal plates during assembling of the mold from the various core plates, which is particularly important in case of cylinders for two-cycle engines, cylinder heads for air-cooled aircraft engines and all work pieces having control ports whose openings must be placed on an accurately determined level, the superposed core plates, if metal holding plates of less thickness than corresponds to the spacing plus thickness of the ribs are employed, are relieved from the pressure produced by the assembling of the core plates by means of compression bars inserted in registering bores of the core plates. This arrangement is illustrated in Figs. 12 and 13 which show a core plate for an air-cooled two-cycle engine cylinder and a section through a number of superposed plates on the line **13—13** of Fig. 12. The metal holding plate **40** of the sand core plate **41** possesses a closed bore **42** and an edge clearance **43** for alining the core plates relative to one another. By inserting a rod in the clearances **43** subsequent alining of the plates is possible, so that in the building up of the mold the plates can be relatively displaced as required for the insertion of the cores. The metal plate **40** has four bores **44** which are in register in the superposed core plates after alinement. During construction of the mold cylindrical members **45**, Fig. 13, whose height is exactly like the spacing plus thickness of the ribs are inserted in the bores **44**. In the finished mold the superposed members **45** form continuous compression bars or struts which relieve the core plates of the weight of the top and insure accuracy to size of the casting in axial direction. When the core plates are produced and used without metal holders, their openings **44** are preferably reinforced by inserted sleeves which may directly serve as spacing means **45**. The bores **42** and the clearances **43** are also suitably provided with a metal lining.

The core plates shown in Figs. 14 to 17 differ from those described in that for the purpose of establishing a firmer union of the sand portion and the metal portion the edges of the metal plate connecting with the sand portion are fitted with pins whose projecting parts are embedded in the platelike sand core. In the core plate shown in Figs. 14 and 15 and serving for forming the hollow mold for a short ribbed piece of the kind used at the upper part of a cylinder head, Fig. 5, the metal plate **46** has a rectangular outer edge corresponding to the form of the molding box in which it is inserted. The inner edge has a polygonal form corresponding to the outer edge **47** of the rib **48** which is to be molded thereby. Into a side face of the metal plate **46** flat grooves **49** are cut which extend from the inner to the outer edge and serve for discharging air and gas from the sand mold. The polygonal inner edge of the metal plate **46** is undercut on both sides to clamp the edge of the sand core plate **53** to the metal plate. The edges **50**, **51** of the plate **46** are bevelled so that the slope corresponds to the counter-templet.

The metal plates **46** are provided on their inner edge where the sand core plate **53** is connected with pins **52** partly projecting from the plates parallel with the sides thereof. The pins **52** are spaced approximately 20 mm., though this distance is preferably decreasing toward the outside in the plate shown in Fig. 14. When the holes for the pins **52** have to be drilled obliquely in places that are difficultly accessible, the projecting portions thereof are bent off into the plane of the plate.

The sand core **53** connected with the pins **52** has the same thickness as the metal plate **46** from the point adjoining the inner edge of the metal plate up to the outer limiting line of the hollow rib space where the real core **48** connects which fills the space between the two ribs. The

portion of the core plate made of sand is reinforced by armoring insertions.

In the construction shown in Figs. 16, 17 the annular metal plate **54** having a thickness equal to the spacing plus thickness of the ribs is provided on the inner edge with pins **55** spaced about 20 mm. whose ends project approximately 5 mm. parallel with the side faces of the plate and are embedded in the sand core during connection of the sand core plate.

Fig. 17 shows the bending of the projecting pin portions into the plane of the annular plate when the holes in which the pins are inserted are drilled obliquely.

ERNEST MAYER.

PUBLISHED
JUNE 15, 1943.
BY A. P. C.

E. MAYER
MOLDS
Filed April 8, 1941

Serial No.
387,531
7 Sheets-Sheet 1

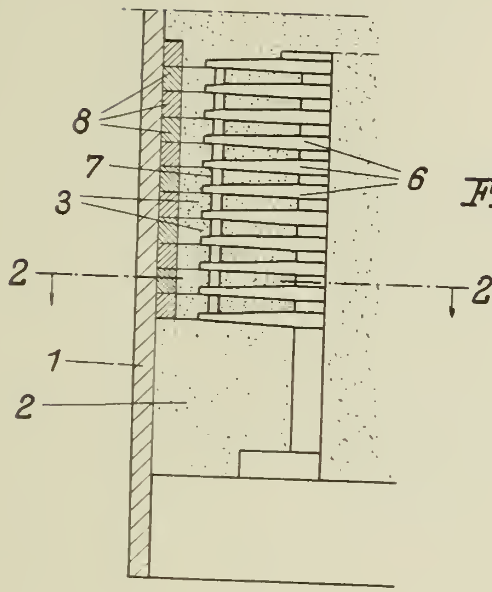


Fig.1

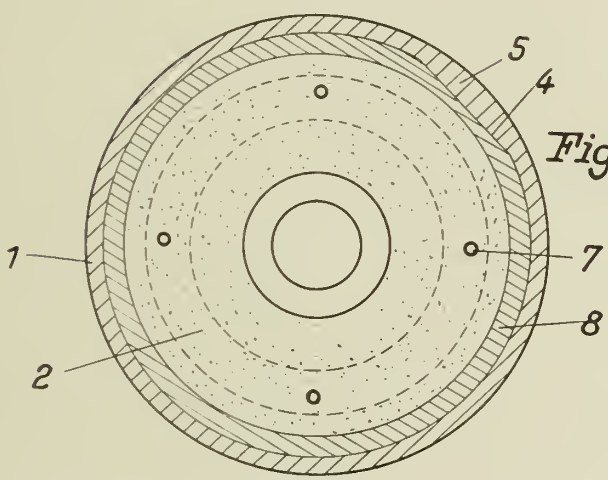


Fig.2

Inventor:
Ernest Mayer,
By Frank S. Appleman,
attorney.

PUBLISHED
JUNE 15, 1943.
BY A. P. C.

E. MAYER
MOLDS
Filed April 8, 1941

Serial No.
387,531
7 Sheets–Sheet 2

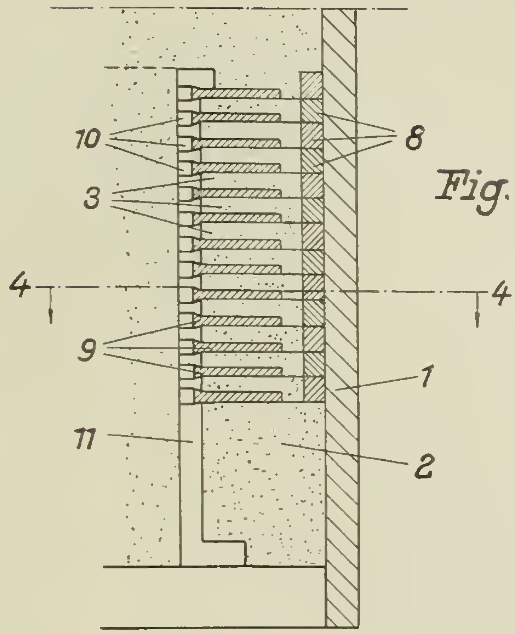


Fig. 3

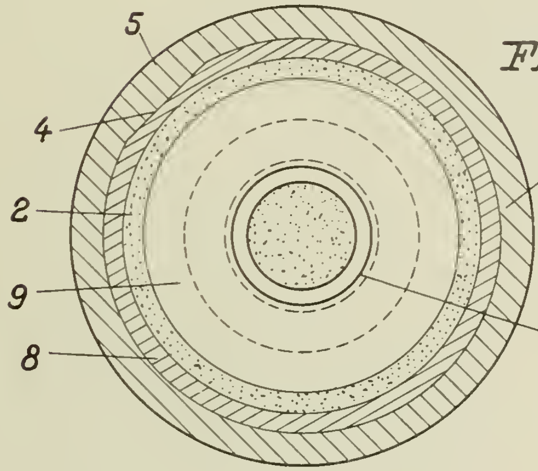


Fig. 4

Inventor:
Ernest Mayer,
by Frank J. Appleman,
attorney.

PUBLISHED
JUNE 15, 1943.
BY A. P. C.

E. MAYER
MOLDS
Filed April 8, 1941

Serial No. 387,531
7 Sheets-Sheet 3

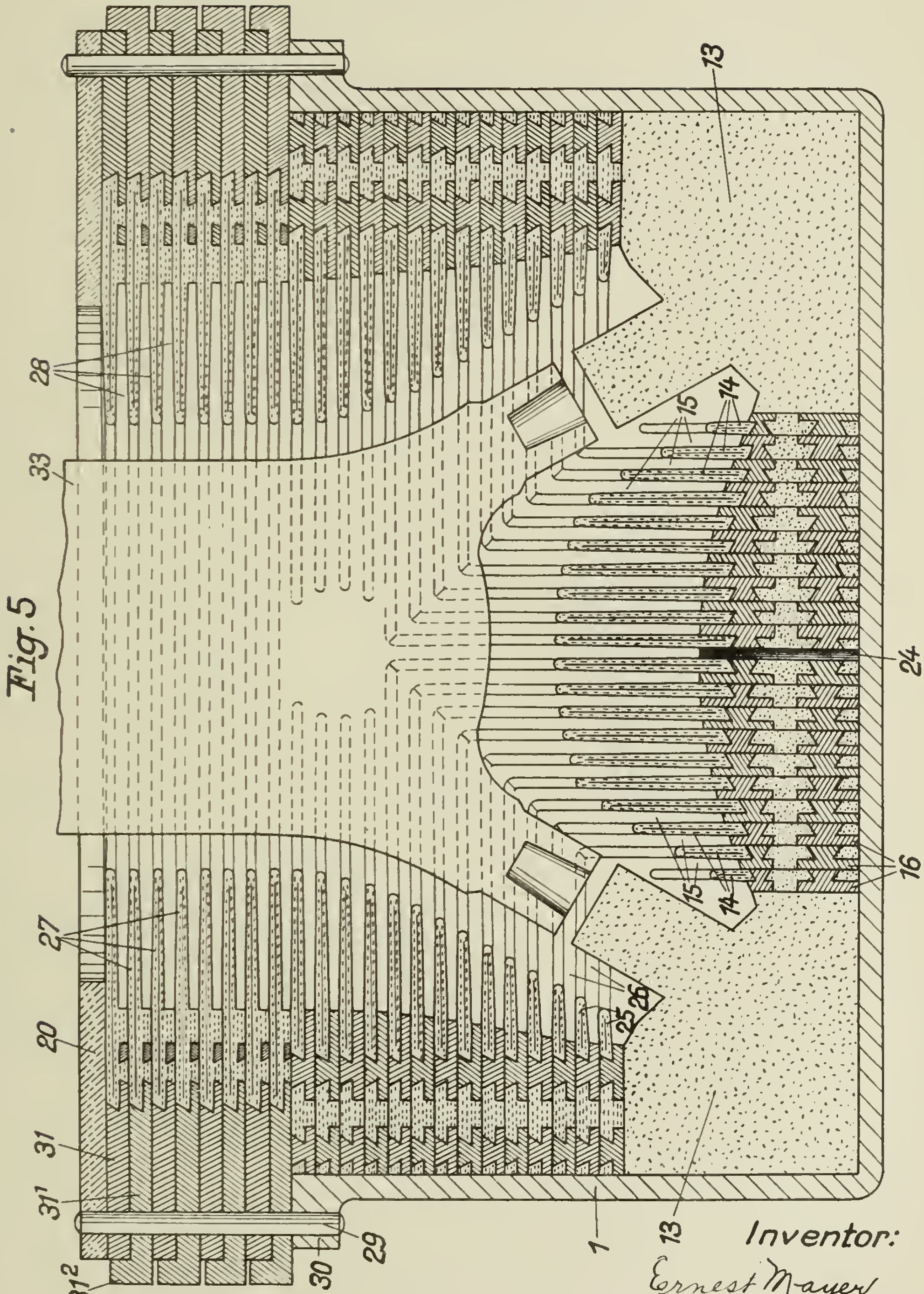


Fig. 5

Inventor:
Ernest Mayer,
Frank S. Appleman,
attorney.

PUBLISHED
JUNE 15, 1943.
BY A. P. C.

E. MAYER
MOLDS
Filed April 8, 1941

Serial No.
387,531
7 Sheets-Sheet 4

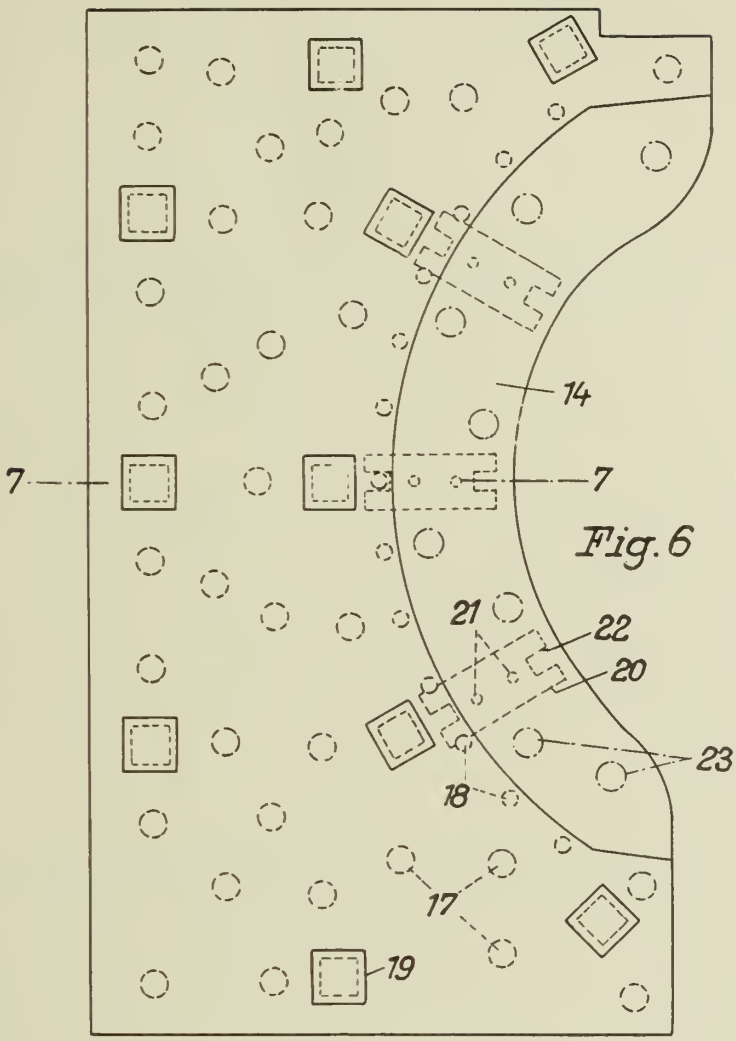


Fig. 6

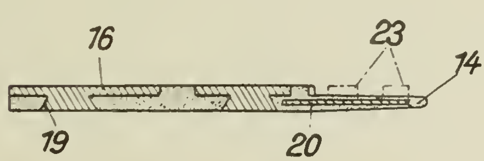


Fig. 7

Inventor:
Ernest Mayer,
Frank S. Appleman,
attorney.

PUBLISHED
JUNE 15, 1943.
BY A. P. C.

E. MAYER

MOLDS

Filed April 8, 1941

Serial No.
387,531

Fig. 8

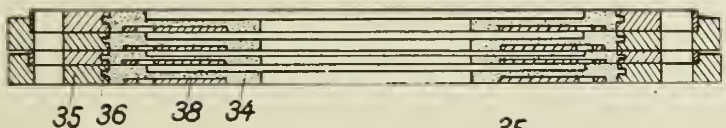


Fig. 9

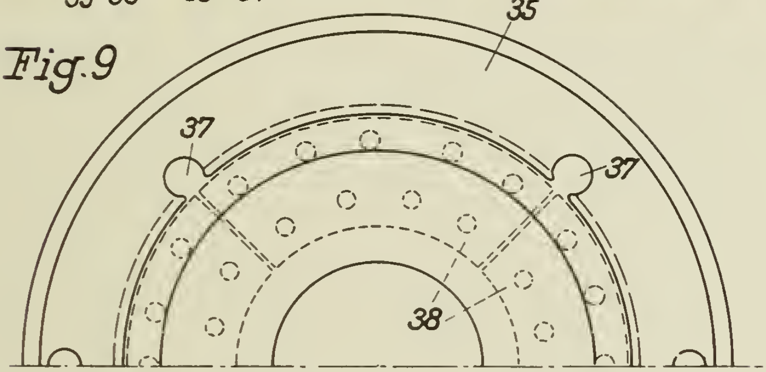
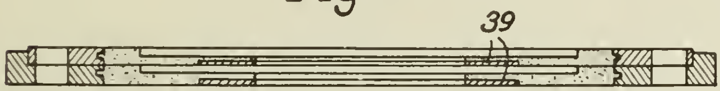


Fig. 10



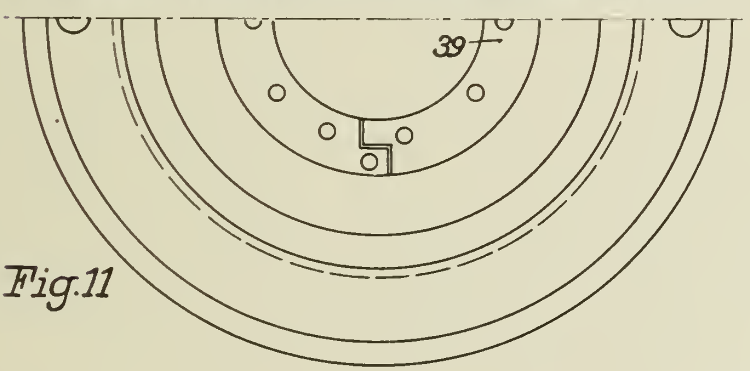


Fig. 11

Inventor:
Ernest Mayer,
Frank S. Appleman,
attorney

PUBLISHED

JUNE 15, 1943.

BY A. P. C.

E. MAYER

MOLDS

Filed April 8, 1941

Serial No.

387,531

7 Sheets-Sheet 6

Fig.12

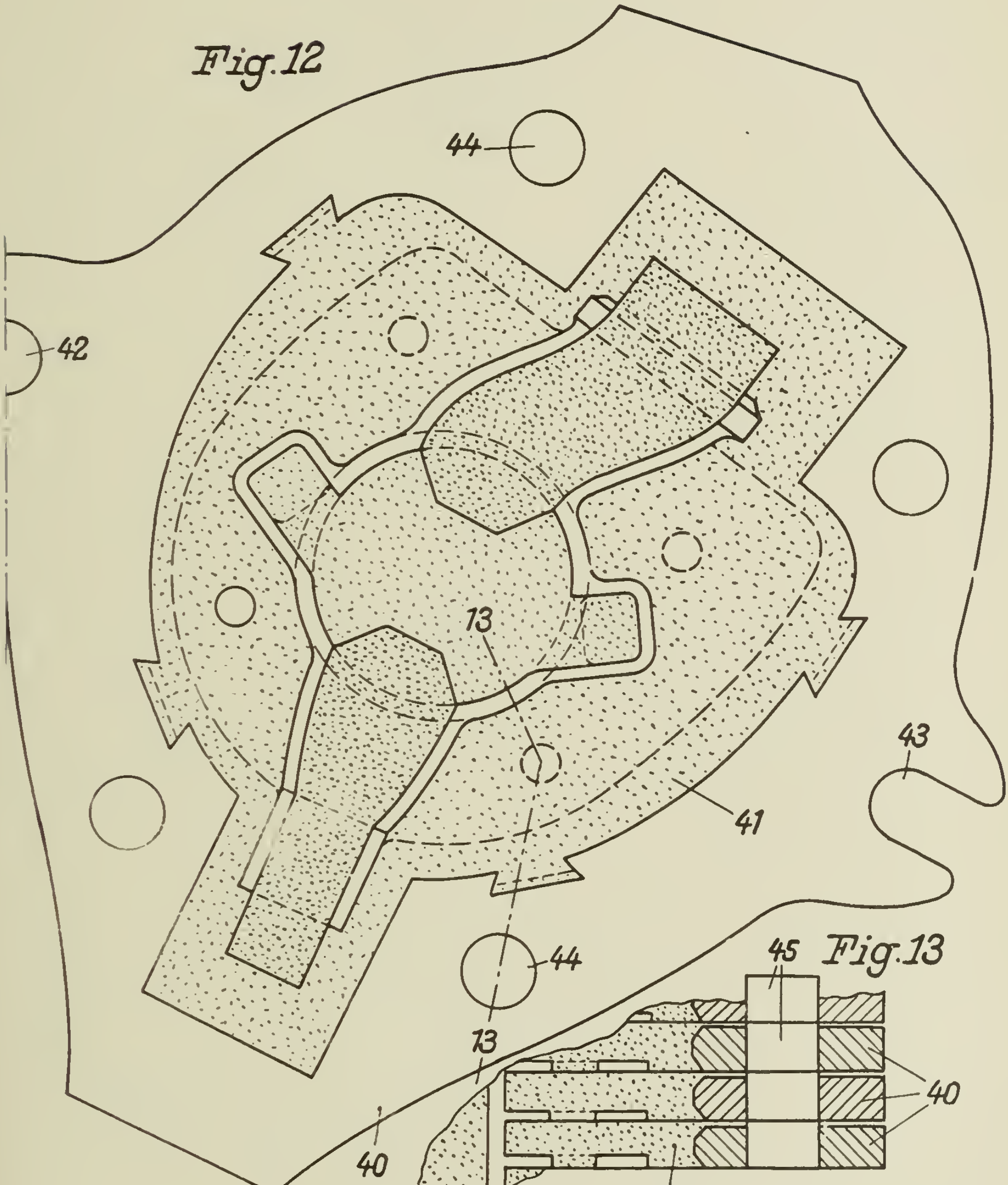


Fig.13

Inventor:

Ernest Mayer,

By Frank S. Appleman,

attorney.

PUBLISHED
JUNE 15, 1943.
BY A. P. C.

E. MAYER
MOLDS
Filed April 8, 1941

Serial No.
387,531
7 Sheets-Sheet 7

Fig. 14

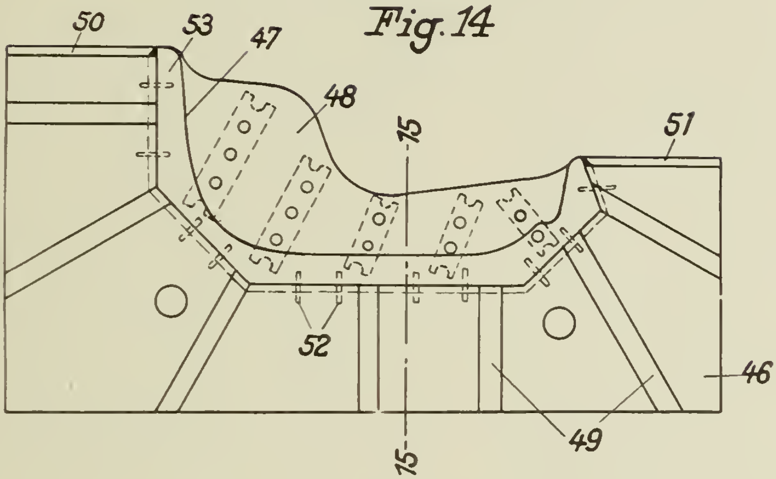


Fig. 15

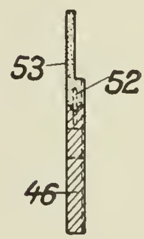
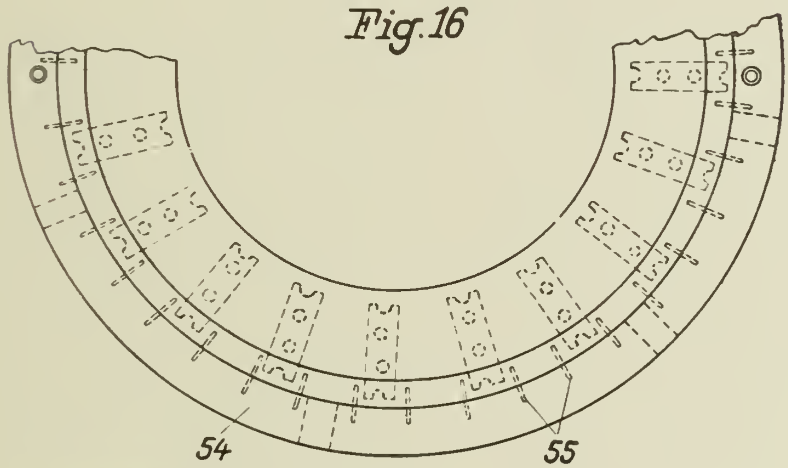


Fig. 16



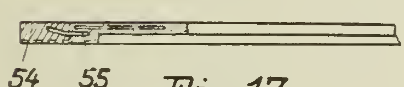


Fig. 17

Inventor:
Ernest Mayer,
By Francis S. Appleman,
Attorney

Published June 15, 1943

Serial No. 388,441

ALIEN PROPERTY CUSTODIAN

MEDICINAL APPLICATOR AND DISPENSER

James P. Robinson, Tokyo, Japan; vested in the Alien Property Custodian

Application filed April 14, 1941

This invention relates to a medicinal applicator and dispenser, and has for its objects an improved device for applying a medicine in the form of a liquid or jelly, to internal body cavities for disinfecting such cavities and which device is flexible and elastic and is provided with a socket for fitting over any suitable, relatively rigid projecture, for supporting the same in the desired body cavity during manipulation thereof, and which device also is formed with a supply chamber adapted to contain a supply of such liquid or jelly or the like, that communicates with a delivery or dispensing chamber, for supplying the contents of the supply chamber to the dispensing chamber for ejection from the latter at points where the said contents will be spread by the walls of the device during manipulation of the latter.

Another object is a dispenser and applicator of the above character having a tubular socket, the walls of which are adapted to be rolled up to an apertured dispensing chamber at one end of the socket in which chamber the apertures are sealed by said walls when so rolled, preparatory to use of the device, and which walls are adapted to be unrolled to progressively enclose therein any suitably shaped supporting member, and when so unrolled for use of the device, the openings in the dispensing chamber will be uncovered for dispensing the contents of the chamber.

A still further object is a tubular socket provided with a closure at one end and a chamber outwardly of such closure having flexible walls with discharge apertures opening outwardly of the socket and chamber, and which walls are so formed as to carry a supply of antiseptic, medicine or the like, and to substantially control the delivery of such medicine from the supply chamber to the apertures for discharge from the latter.

Other objects and advantages will appear in the description and drawings.

Fig. 1 is a part sectional, part elevational view of my dispenser and applicator, partially broken in length.

Fig. 2 is an elevational view of my dispenser previous to use when sealed by the socket walls of the device.

In detail, my invention comprises a tubular socket member **1**, open at one end and formed with a reinforcing ring **2** at said end.

The opposite end is closed by a concavo-convex imperforate end wall **3**, the concave side of which faces into the socket in member **1**. This end wall and walls **1** are preferably integral.

Over the convex outer side of wall **3** is a cap **4**, connected at its edges at **5** adjacent the juncture between wall **3** and walls **1**.

The cap **4** is also generally concavo-convex, with its concave side facing the convex outer side of end wall **3**, but spaced from said end wall, thus providing a chamber **6** between said cap and end wall. Adjacent the connection **5** between the cap and socket member **1**, are one or more discharge apertures **7** that open generally radially outwardly of the central axis of the socket member **1**. Preferably several of these openings are provided at equally spaced points around the margin of cap **4**.

The cap **4** is centrally formed with bulbous chamber **8** projecting axially outwardly of cap **4**, and which chamber **8** communicates with chamber **6** by a restricted passageway **9** that is coaxial with member **1**. A neck **10** may form the walls of said passageway, and also connect the walls of chamber **6** with the walls of chamber **8**.

These chambers **6**, **8** may be filled with a germicidal, or antiseptic or medicinal liquid, or jelly **11** through one of openings **7**, after which the walls of the socket member **1** are rolled on ring **2** from the open end of the socket member toward the end **3**. This rolling is permitted by reason of the fact that the walls **1**, as well as end wall **3** and cap **4**, including the walls of chamber **8** and neck **10**, are of relatively thin, elastic, flexible rubber or the like.

The rolling up of walls of socket member **1** continues until the margins of end wall **3** and cap **4** are included in the annular roll formed by walls **1**, and the apertures **7** will then be positively sealed, against leakage of the material **11** from the chamber **6** until the walls **1** are unrolled as shown in Fig. 2.

The socket, being tubular and elastic, is adapted to receive therein, and to tightly embrace any suitable projecture, such as a finger, probe, etc., that is adapted to be inserted in a body cavity. The rolled up dispenser, as indicated in Fig. 2, is readily applied to such projecture by merely placing one end of the latter against the wall **3** and unrolling the walls **1** or skirt portion of chamber **6**, in the same manner as a rolled stocking is unrolled on the leg of a wearer. This unrolling of the walls **1**, uncovers the apertures **7**, and the device, supported on the support enclosed in the socket member, is ready for use.

In operation, when the supported applicator, ready for use, is inserted into any body cavity, tract, or opening, with the chamber **8** leading, it will be seen that some of the contents of the chamber **6** will be ejected through openings **7** on

the lining of such tract or cavity, but this ejection is, many times heretofore, undesirably restricted by the lining itself, or the contents may be completely ejected too quickly to most efficiently sterilize or disinfect the desired area in the tract or cavity. By the provision of chamber **8**, even though the contents of chamber **6** may be completely ejected before the discharge openings reach the desired area, there will be a supply remaining in said chamber **8**, which will be ejected into chamber **6** through the restricted passageway **9**, and from chamber **6** through apertures **7** to the desired area, upon reciprocation or manipulation of the applicator at, or adjacent said area, in a manner to create a pressure against the walls of chamber **8**. If the ejection of the contents **11** tends to be blocked by the lining of the body tract or cavity, then similar manipulation of the applicator will force the contents out of apertures **7** and into the cavity or tract. Thus, the chamber **8** is a supply chamber, while chamber **6** is a dispensing chamber from which the contents are ejected through apertures **7**, and the apertures **7**, being in the margin of wall **4** close to the socket walls **1** and practically parallel with said walls **1**, it is manifest that the apertures **7** are sealed on opposite sides by wall **1** and by wall **3** when the ring **2** with walls **1** rolled therein cover apertures **7**, and there is no substantial pressure created on the contents enclosed in the dispensing and supply chambers.

The restricted neck **10** controls the passage of the contents of chamber **8** into the dispensing chamber **6**, and in most instances, the chamber **8** will carry the contents thereof into a body cavity until the chamber **8** engages the end of such cavity, when said contents will be pumped, as it were, into chamber **6** and out of the discharge apertures **7**, thus insuring a dispensing of the material **11** at a point in the cavity remote from its opening.

JAMES P. ROBINSON.

PUBLISHED

JUNE 15, 1943.

BY A. P. C.

J. P. ROBINSON

MEDICINAL APPLICATOR AND DISPENSER

Filed April 14, 1941

Serial No. 388,441

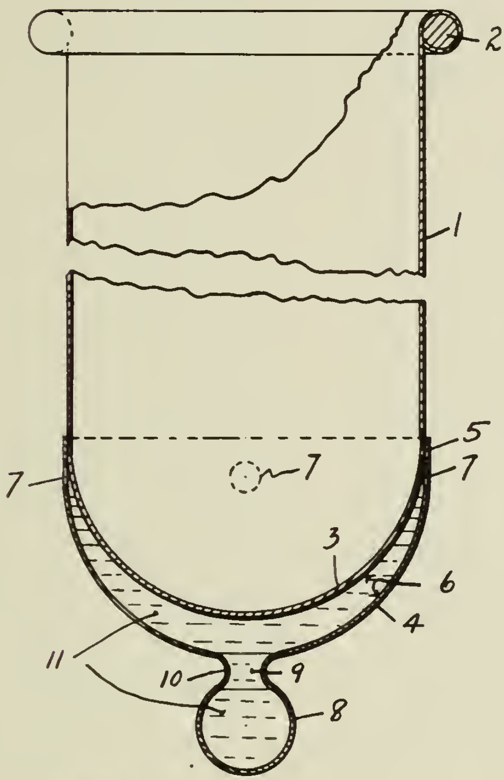


FIG. 1.

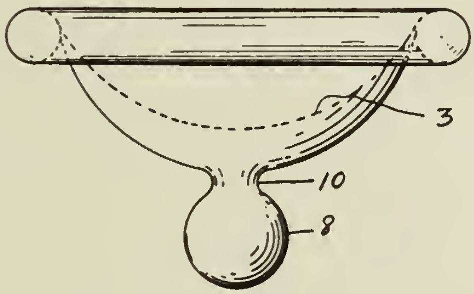


FIG. 2.

INVENTOR.
JAMES P. ROBINSON

BY Boyken & Mohler

ATTORNEYS

Published June 15, 1943

Serial No. 388,811

ALIEN PROPERTY CUSTODIAN

CURRENT-GENERATING GEAR FOR POCKET ELECTRIC LAMPS

Georges Bardin, Tournus, France; vested in the Alien Property Custodian

Application filed April 16, 1941

Several types of pocket or portable electiic lamps containing a manually operated current-generating magneto are already to be found on the market as substitutes for such lamps containing a small dry battery which, as is well known, becomes rapidly exhausted. The principal disadvantage of such lamps comprising a magneto as a source of current is that the gear used for transmitting the manual impulses to the rotor of the magneto is of a complicated and cumbersome structure, whereby the rotor and stator of the magneto itself are of correspondingly reduced volume and output, so that in order to properly generate the current which is necessary for ensuring an adequate light power, the rotational speed of the magneto rotor must reach very high values of the order of 8,000 to 10,000 R. P. M. This involves the necessary use of several gear couples operated by racks or similar contrivances which absorb a substantial proportion of the effort and require undue lubrication and a very minute adjustment of the parts, also rubber mountings capable of avoiding jerks and "whistling" as caused by too quick meshing of the teeth of the gears.

An object of the present invention is to provide a current-generating gear for pocket or portable electric lamps of the aforesaid type having such an improved and simplified structure as to avoid the foregoing disadvantages, said improved gear comprising one gear couple only, thus leaving a much larger space for the accommodation of the magneto itself and lessening losses due to frictions, while not increasing the overall size of the self-contained lamp.

Another object of the invention is to provide a current-generating gear for lamps of the aforesaid type wherein the parts of the gear are so co-related that intermediate two consecutive impulses of the manually operated actuator such as a pivotal and reciprocatory handle, all such parts remain motionless with the exception of the magneto rotor whose momentum may be better maintained and regularized by providing the same with a flywheel made of a non-magnetic metal or alloy.

Still another object of the invention is to provide a novel current-generating gear for pocket electric lamps of the aforesaid type wherein the rotational speed of the magneto rotor is held within relatively small limits, thus considerably lessening vibrations and frictions and consequently doing away with the need of rubber mountings and frequent lubrication.

A further object of the invention is to provide a novel current-generating gear for lamps of the aforesaid type wherein the parts of the gear couple may be constructed with less accuracy, thus diminishing to a material extent the manufacturing cost as well as the risk of breakdown while rendering the general construction more rugged and durable.

A still further object of the invention is to provide a novel current-generating gear for lamps of the aforesaid type wherein the rotor when advantageously fitted with a flywheel adapted to regularize its momentum and to ensure a better employment of the characteristics of the magnetic circuit can be readily cast in the form of a solid disc having a central bore in which a core formed with a ratchet-carrying flange can be readily accommodated and held in proper centered position.

With these and such other objects in view as will incidentally appear hereafter, the invention comprises the novel construction, combination and arrangement of parts that will now be described with reference to the accompanying diagrammatic drawing exemplifying the same and forming a part of the present disclosure.

In the drawing:

Figure 1 is a view partly in section of the electric lamp with its current-generating gear accommodated in its casing.

Figure 2 is a sectional view on the line A—A of Fig. 1.

Figures 3 and 4 are respectively a plan view and a sectional view of a magneto whose rotor is fitted with a flywheel.

Figure 5 is a fragmentary detail view showing a modified construction of the actuator, link, toothed sector and ratchet.

Figure 6 is a sectional view showing a preferred structure of the magneto rotor, central core and associated parts.

Like reference numerals designate like parts throughout the several figures.

In the showing of Figs. 1 and 2, the magneto primarily comprises a star-shaped rotor **1** made of soft iron having four poles **2** made of a magnetic alloy, and a field stator **3** provided with oppositely arranged windings and with a pair of tapering polar shoes. This construction is not evidently limitative, it being possible of course to use a magneto comprising a rotor with two, six, eight or more poles in even number and a corresponding stator having a polar shoe for each pair of such poles. The rotor or magnet proper is preferably made of nickel-aluminum or a similar alloy.

The axis **4** of the rotor **1** journalled in the side

plates of the box-like casing 21 has mounted thereon a unidirectional impeller or free wheel clutch, for example a ratchet pinion 5 associated with a pair of pawls 22, 23 and meshing with a toothed sector 6 fast on an axis 7. The toothed sector 6 is driven by means of a reciprocatory actuator or handle 8 pivotally carried at 20 on the casing 21 and transmitting its motion through a link 9 pivoted at 10 on said handle and at 11 on said sector.

By a suitable adjustment or setting of the pivotal points 10 and 11, the proper increasing ratio of the gearing which may be conveniently equal to 1:2.5 may be obtained. Such ratio may be conveniently altered when required without changing the parts, it being sufficient in such an event to change the positions of the point of operative engagement of the link 9.

The device shown in Figs. 3 and 4 shows the construction of the magneto as fitted with a flywheel adapted to maintain or regularize its momentum. This device comprises a magnetic rotor 15 constituted by a solid disc free of projecting poles and made of a nickel-aluminum or like alloy. This rotor has its axis provided with a free wheel clutch as shown in Fig. 1 and is operatively connected to a flywheel 16 made of a non-magnetic metal (preferably lead) arranged so as to circumscribe the stator 17.

As will be understood, the relatively high kinetic energy which, considering its weight, is imparted to the flywheel 16 by each impulse derived from a motion of the handle 8 enables it to maintain the rotational speed of the magnet substantially constant during a much longer time after each of such impulses, whereby the tension of the generated electric current decreases slowly. This makes it possible to obtain proper and steady voltage by using one magnetic couple (rotor-stator) of small overall size and causing it to revolve at moderate speed.

The device assembly is actuated by the handle, link and toothed sector as described with reference to Fig. 1.

In the constructional modification shown in Fig. 5, the link 9 is replaced by a sliding rod 12 fitted with a pin 13 engaging through a slot 14 in an extension of the toothed sector 5. Around the rod 12 is coiled a helical retract spring 24 abutted between a boss on the handle 8 and a shoulder on the casing 21. The sector 6 may be provided with teeth only on a portion B of its arc-shaped face A, so that at the end of each rocking motion of this sector, it no longer engages the ratchet pinion. This reduces frictional stresses because otherwise when the sector 6 remains in constant mesh with the pinion 5, the pawls such as 22 and 23 rub its teeth all the time and take up an important fraction of the momentum of the magnet secured to said pinion.

According to the method of making the rotor or magnet as shown in Fig. 6, said magnet 15 is formed as a solid disc having a central bore which may be left bare as the magnet results from the casting operation or may be machined afterwards. In this bore is accommodated a centering core 18 provided with a flange serving as a carrier for the free wheel clutch. The core 18 is conveniently cast and made either of white metal or "Bakelite". This method makes it possible to substitute for the disc carrying the pawls and pawl springs which is costly to produce since it must be reduced in diameter, cut away and pierced, a cast part whose holes and grooves are produced in the casting operation itself. Moreover, this method also does away with difficulties encountered for securing the disc to the magnet, it being known that magnetic metals and particularly nickel-aluminum alloys cannot be machined with usual tools and must be wrought by means of grinding wheels.

As an alternative of the method just described, the rotational axis 19 of the magnet may be cast in situ when the white metal or "Bakelite" is injected into the die, thereby also obviating the difficulties otherwise encountered for securing the same.

It will be appreciated from the foregoing description that the objects of the invention are satisfactorily fulfilled by this improved construction since the use of one gear couple diminishes frictions, vibrations and lubrication needs, avoids rubber mountings sometimes called "silentblocks" and therefore reduces costs of manufacture and assembly while leaving more room for the current-generating parts themselves, and while accordingly permitting them to be rotated at a lower speed. Furthermore, the provisions of a flywheel in conjunction with the unidirectional impeller comprising the ratchet maintains and regularizes the momentum of the rotor, which renders the electric current thus generated more regular and avoids flickering of the light. Lastly, the provision of teeth on a portion only of the impeller sector materially lessens frictions and therefore the wear and tear of the parts.

As a consequence of these combined factors, the lamp thus equipped while having a nicely limited over-all size which makes it convenient and handy to carry about and accommodate in a garment pocket possesses high luminous efficiency and requires only such a limited manual effort as will warrant prolonged use without fatigue to the user's hand.

GEORGE BARDIN.

PUBLISHED

JUNE 15, 1943.

BY A. P. C.

G. BARDIN
CURRENT-GENERATING GEAR FOR POCKET
ELECTRIC LAMPS
Filed April 16, 1941

Serial No.
388,811

Fig. 1

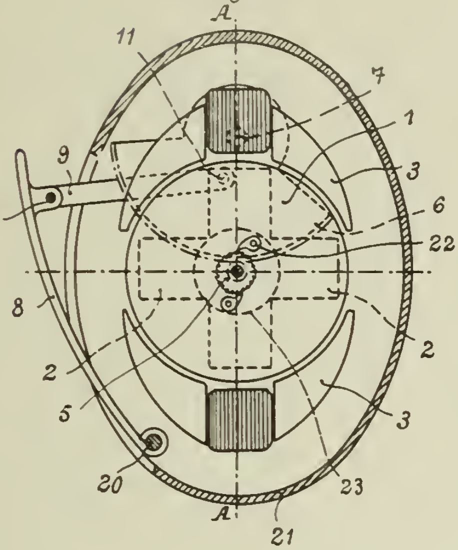


Fig. 2

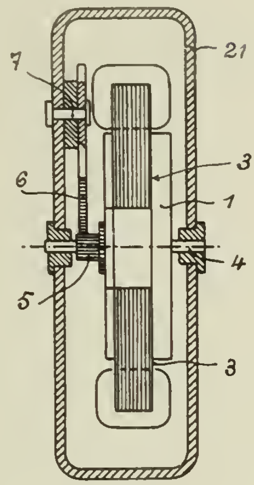


Fig. 3

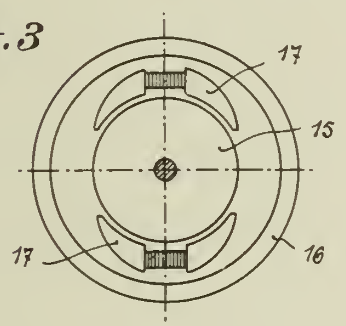


Fig. 4

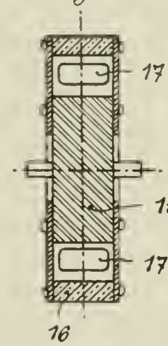


Fig. 5

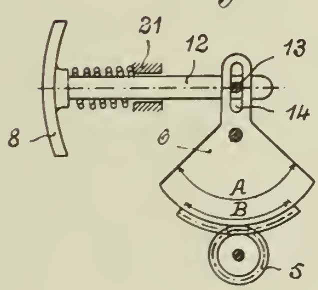
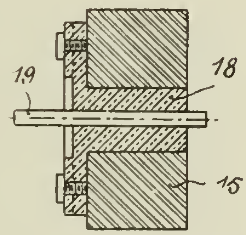


Fig. 6



Inventor
Georges Bardin
By
his ATTY.

Published June 15, 1943 Serial No. 391,198

ALIEN PROPERTY CUSTODIAN

MANUFACTURE OF MOLDED REINFORCED OBJECTS

Eugene Adrien Chapuis, Oyonnax, France; vested in the Alien Property Custodian

Application filed April 30, 1941

My invention relates to the manufacture of moulded objects by injection under pressure of plastic compounds such as synthetic resins, thermo-plastic materials, rubber and rubber derivatives, etc. and it refers more particularly to the manufacture of such objects which are re-inforced by a core or armature.

One object of my invention is a moulding process of re-inforced objects wherein the core or armature is secured within the mould by means which are removed from contacting with said core when a substantial mass of the moulding compound has been forced into the mould, the void space left by the said means being filled by a further supply of moulding composition under pressure.

A further object of my invention is a mould provided with movable core supporting means.

Still a further object of my invention is a mould with movable core supporting means wherein the latter are automatically displaced by the moulding compound injected into the mould; the said core supporting means, in the case of an at least partial cylindrical or toric or the like object, being preferably formed by a piston provided with a core receiving hole and slidable within the corresponding part of the moulding recess proper.

The support may be so shaped as to form the end of the moulded object, such as the tip of a knitting needle.

The support may be loaded by a spring in such a manner as to be displaced by the injected compound only when the mould is nearly filled.

Other features of my invention will be apparent from the foregoing description in reference to the annexed drawing wherein:

Fig. 1 is a sectional elevation of a mould established in accordance with my invention.

Fig. 2 is a partial section taken along line II—II of Fig. 1.

Fig. 3 is the corresponding end view.

Fig. 4 is a diagrammatic view of a multiple mould.

Fig. 5 is a sectional elevation of a modification.

Fig. 6 shows a further modification.

The mould illustrated in Figs. 1 to 3 comprises two parts 1 and 1′ with a moulding recess 2 and an inlet passage 20 provided through part 1. Within the moulding recess 2 there is arranged a core or armature 3 generally of metal which is to become embedded in the finished object, the said core or armature being held by a plurality of pairs of supports 4, 4′. The two supports of each pair are slidably carried by opposed holes provided in parts 1 and 1′, respectively, the said holes opening into recess 2. Supports 4, 4′ are thus movable with respect to core 3 between an active position shown in which they bear against core 3, and an inactive position in which their inner end, suitably shaped, are flush with the walls of recess 2.

Supports 4, 4′ may be cylindric or prismatic. Their section is larger in the portion which does not project into recess 2 in order to simplify their machining and to improve their mechanical strength.

Supports 4, 4′ may be controlled manually. In the example illustrated, each support terminates outwardly into a spherical end 5 which is engaged into a groove 6 provided in a transverse bar 8. There is provided one bar 8 for each support 4 or 4′ and each bar is guided within a groove 7 on the outer surface of the mould. All the bars 8 on one and the same face of the mould are secured to two parallel longitudinal rods 9.

The mould also supports a rotatable shaft 12 carrying two toothed wheels 14 and 14′ and each wheel 14 or 14′ meshes with two racks 10 and 11, respectively 10′ and 11′, said racks being parallel to bars 8 and slidable within guides 13. Racks 10, 11, 10′ and 11′ are formed with oblique elongated openings 16, arranged in parallel relation and adapted to coact with fingers 15 formed at the ends of rods 9. A hand actuating lever 18 is keyed on shaft 12.

The operation is as follows:

The mould is closed, the core or armature 3 being secured within the moulding recess 2 and coaxially to the same by supports 4 and 4′ at their active position. The plastic compound is then injected under pressure into the mold through passage 20. Towards the end of this operation, lever 18 is actuated. Wheels 14 and 14′ are thus rotated and racks 10, 11, 10′ and 11′ slide in the respective directions indicated by arrows in Fig. 3. Fingers 15 are displaced along openings 16, and supports 4, 4′ operatively connected with said fingers are brought from active to inactive position, their inner ends forming parts of the walls of the moulding recess, as explained, the core being maintained by the compound in which it is embedded.

A further supply of compound is then injected into the mould to fill the void spaces left by the supports 4, 4′. The object is then finished and may be removed from the mould when the compound is set. The removing of supports 4, 4′ may take place before the mould is wholly filled and as

soon as there is a sufficient quantity of compound to support the core, in which case the supply of mouldable compound is uninterrupted.

Fig. 4 diagrammatically shows a multiple mould comprising a plurality of moulding recesses 2, 2', etc., into which the moulding compound is forced by the same passage 20 which communicates with all the recesses. All the supports 4, 4' cooperating with the successive recesses are simultaneously actuated by a common gearing similar to the gearing described with reference to Figs. 1 to 3.

The modification shown in Fig. 5 relates to the moulding of elongated objects such as knitting needles. The moulding recess is cylindrical or prismatic or toric or the like. Core 3 is formed of a rod smaller in length than the recess, said core being held by one of its ends 22 in a housing formed between parts 1 and 1' of the mould. A piston 23 is slidably mounted within the moulding recess 2. Piston 23 is provided with an axial bore 24 for core 3 and its length is somewhat smaller than the space available between the free end 26 of rod 3 and the corresponding end 25 of the moulding recess 2.

There is also provided within recess 2 a rod 28 projecting from end 25 and adapted to obturate the bore 24 when the piston 23 abuts against the end 25 of the recess 2, at the end of its stroke (position shown in chain dotted lines on Fig. 5). The end surface of the rod 28 cooperates with the end surface 27 of the piston, and said surfaces are suitably shaped to form the end surface of the object to be moulded i. e., in the example illustrated the tip of the knitting needle.

Passage 20 opens in the vicinity of end 22 and piston 23 is placed near passage 20, as shown, when the core 28 is placed in position within the mould. The moulding compound is injected into the mould through the passage 20. It is understood that said compound fills the space situated between the end 22 and the piston 23 and then pushes the piston 23 towards the end 25. The various parts of the core are thus maintained in the proper axial position by the piston until they are embedded in the compound and thus immobilized. When the piston 23 abuts against the end 25, the mould is filled and the surface 27 forms with the end of the rod 28 the tip of the needle which is thus obtained in a single operation.

In the modification illustrated in Fig. 6, which also relates to the manufacture of elongated objects, the core 3 is secured by one end 24 clamped between parts 1 and 1' of the mould, while its other end is housed in a blind hole provided in a piston 23 loaded by a spring 30 resting against the corresponding end 31 of recess 2. The latter is cylindrical, prismatic or toric or of like shape at least on a certain length starting from end 31, in such a manner that it may work as a cylinder for piston 23.

When the moulding compound is forced into the mould through the passage 20, it fills the recess 2 around core 3 and then pushes piston 23 against the action of spring 30. Since the core is then held by the compound, it retains substantially its axial position notwithstanding the movement of piston 23. As in the case of Fig. 5, the latter may be so shaped as to form the corresponding end of the object.

EUGENE ADRIEN CHAPUIS.

PUBLISHED

JUNE 15, 1943.

BY A. P. C.

E. A. CHAPUIS

MANUFACTURE OF MOLDED REINFORCED OBJECTS

Filed April 30, 1941

Serial No. 391,198

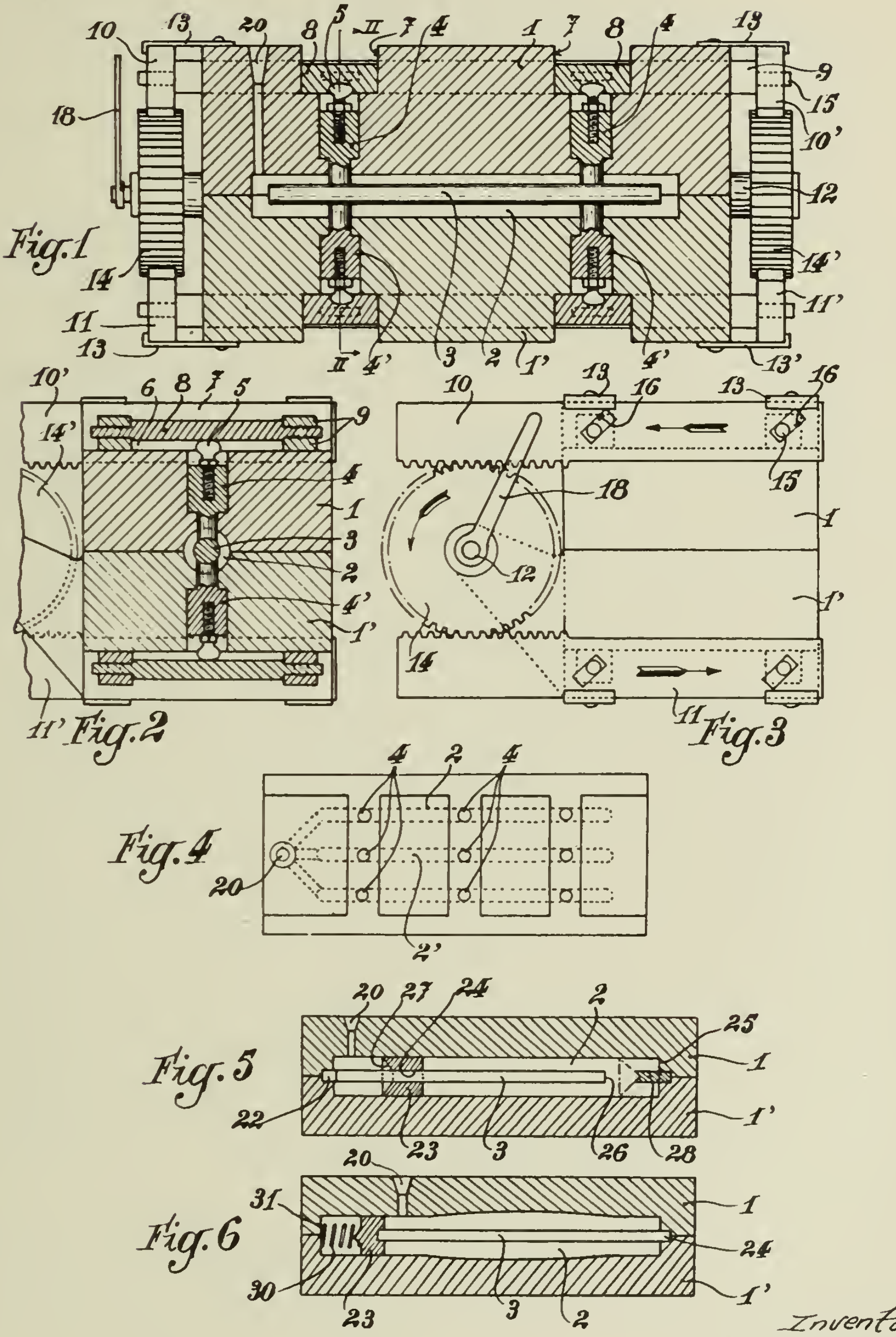


Fig. 1 Fig. 2 Fig. 3 Fig. 4 Fig. 5 Fig. 6

Inventor,
E. A. Chapuis

By: Glascock Downing & Seebold
Attys.

Published June 15, 1943

Serial No. 393,137

ALIEN PROPERTY CUSTODIAN

EXPLOSIVE AND METHOD OF MAKING THE SAME

Charles Baron, Grenoble, France; vested in the Alien Property Custodian

No Drawing. Application filed May 12, 1941

This invention relates to an improved form of explosive powder and method of making the same.

Ammonium nitrate has been used in the past with carbon to form an explosive powder but due to the absorbent character of the ammonium nitrate whereby it absorbs moisture from the air, the powder was not easily preserved and, in addition, the use of other elements, such, for example, as aluminum, which might be adversely affected by the absorbed moisture, was prohibited.

The principal object of my invention is to provide a powder mixture and to combine same in such a manner with such ingredients as to prevent the absorption of moisture by the resultant mixture and to enable said mixture to include elements, which otherwise would be impracticable and which improve the explosive character of the powder.

Another object of my invention is to provide a powder mixture and to combine same in such a manner with such ingredients as to lower the sensibility of the mixture to shock and thus enable the mixture to include elements, such as alumium, which otherwise would be impracticable and which improve the explosive character of the powder.

Other and further objects of this invention will become more apparent as the same becomes better understood from an examination of the specification and claims.

I mix the powdered ammonium nitrate with pitch of petroleum in a thorough and intimate manner so that each particle of the powder is covered with a light film of the pitch which acts as insulating material and forms a coating. I also include in the mixture, before application of the pitch, fine powdered aluminum metal in proportions to secure the following chemical reaction upon explosion:

$$3NH_4NO_3+2Al=6H_2O+Al_2O_3$$

The combustion or explosion resulting gives 685 liters of gas (calculated at atmospheric pressure and 15° C) but the temperature resulting from combustion is very high amounting to 4480° C with corresponding increase in volume in proportion to increase in temperature. This great increase in volume results in an enormous increase over the results of the explosion according to the usual combustion of ammonium nitrate in combination with carbon under the old formula:

$$2NH_4NO_3+C=CO_2+4H_2O+N_2$$

which gave 905 liters (calculated at atmospheric pressure and 15° C) but in which the combustion only raised the temperature to 2530° C.

The great increase in temperature obtainable in the combustion of my mixture which attains the high point of 4480° C compared to the relatively low temperature of 2530° C under the old mixture provides a comparison of 12000 developed in the reaction of the former to 9400 developed in the reaction of the latter.

Compared to other types of explosives used for industrial and war purposes such as those using chlorates and perchlorates of potassium, natrium or ammonium, my explosive is much less sensitive to shock due to the coating of petroleum pitch on the minute particles. This coating of petroleum pitch renders the nitrate insensible to humidity, since, I have found that, after two months exposure to the open air, the retaking of moisture is only .31%. The addition of the aluminum powder to chlorates and perchlorates results in the most powerful explosive which is known at the present time but without this coating of petroleum pitch on the particles of the mixture, which I also apply thereto in the same manner as described above in connection with the nitrate and aluminum mixture, the mixture would be too sensitive to shock to render the use of the chlorates and perchlorates with aluminum powder practicable.

I am aware that many changes may be made and details varied without departing from the principles of my invention and I therefore do not wish to be limited to the details shown or described.

CHARLES BARON.

Published June 15, 1943

Serial No. 393,138

ALIEN PROPERTY CUSTODIAN

FUEL HUMIDIFIER FOR INTERNAL COMBUSTION ENGINES

Charles Baron, Grenoble, France, and Albert Verley, Chicago, Ill.; vested in the Alien Property Custodian

Application filed May 12, 1941

This invention relates to an improved device for humidifying the gaseous component of the fuel admitted to an internal combustion engine.

Devices have been suggested heretofore for adding water vapor to the air intake of a carburetor or for adding such vapor to the gas of an internal combustion engine but we have found that by commingling the intake air with the proper fineness and extent of water particles in their natural state, rather than merely adding steam or water vapor to the air, a maximum of efficiency in gasoline consumption is obtained. A corresponding efficiency should be obtainable by so commingling the gaseous fuel of a gas internal combustion engine.

Accordingly the primary object of this invention is to provide an apparatus and a method for humidifying the gaseous fuel medium, including air, delivered to an internal combustion engine by entraining water particles in said medium in their natural state, rather than merely in the form of vapor, and also distributing said particles throughout said medium in uniform particles.

Other and further objects of this invention will become more apparent as the same becomes better understood from an examination of the specification and claims.

Fig. 1 represents a side elevation of an internal combustion engine provided with a fuel humidifying device embodying this invention;

Fig. 2 is an enlarged fragmentary detail vertical sectional view of the humidifying device shown in Fig. 1.

Referring to the drawings more particularly, reference character **1** designates generally an internal combustion engine provided with a radiator **2**, intake manifold **3** and carburetor **4**.

A humidifier device, shown more in detail in Fig. 2, is provided with a sheet metal shell **5** shaped to provide opposed circular recessed shoulders **6** and **7** for centrally supporting a cylindrical porous porcelain member **8**. The shoulders **6** and **7** surround openings in the shell **5**, forming an inlet **9** and an outlet **10**, respectively. The shell **5** cooperates with the outer wall of member **8** to form an annular water compartment **11**.

Water to compartment **11** is supplied by a pipe connection **12** which may be connected to any suitable source such as tank **2*a*** which preferably contains distilled water which will not clog the pores of porcelain member **8**. Water may be drained from compartment **11** by opening a petcock **13** in shell **5**.

In order that a maximum of efficiency may be obtained, we have found by extensive experiments that the porosity of member **8** is preferably between 25 and 35 but may be between 20 and 40. This particularity of porosity is essential to cause member **8** to permit streams of water to seep through its walls of such fineness as to present beads of water on the inner surface of the proper fineness to be entrained in its natural state rather than merely as water vapor by the air drawn through from inlet **9** to outlet **10** as will be hereinafter apparent.

We have found that the internal surface of member **8** should be greater for engines of larger horse power than for engines of smaller horsepower. For a 20 horse power engine, we have found the following dimensions of member **8** to work very efficiently: 6″ in length, 3″ external diameter and 2″ internal diameter.

The shell **5** is suitably connected by a coupling pipe **14**, leading from outlet **10**, to the inlet of the carburetor **4** and the latter has its outlet connected, through means of a coupling **15**, to manifold **3**. A fine wire screen **16** is provided between the flanges of coupling **15** so as to distribute the fine particles of water uniformly after they have been entrained in their natural state and after the gasoline has been commingled with the combined air and water to assure the particles of gasoline being combined and enveloped by the water particles.

By use of the fore-going device and apparatus, wherein the intake air is commingled with fine particles of water in its natural state and the fuel particles are themselves enveloped with a film of water, rather than merely with water vapor, we have actually obtained a decrease in fuel consumption of from 10% to 20%.

The quantity of water consumed by the use of the afore-described apparatus varies between 5% and 10% of the volume of gasoline consumed.

Our understanding of the underlying theory of the afore-described apparatus and its accomplishments is that the finely divided water particles form an emulsion with the particles of gasoline wherein the latter are protected by an external layer of water which prevents automatic premature combustion, due to compression heat, before the sparking point in the engine, and thus eliminates the retarding effect and waste of such combustion of any substantial part of the fuel charge and increases efficiency.

When water vapor or steam alone is combined with the fuel particles the latter are not individually and sufficiently protected by envelopment by a film of water so as to prevent the afore-said automatic premature combustion of any substantial part of the fuel charge and the afore-said efficiency is not accomplished.

We are aware that many changes may be made and details varied without departing from the principles of our invention and we therefore do not wish to be limited to the details shown or described.

CHARLES BARON.
ALBERT VERLEY.

PUBLISHED
JUNE 15, 1943.
BY A. P. C.

C. BARON ET AL
FUEL HUMIDIFIER FOR INTERNAL
COMBUSTION ENGINES
Filed May 12, 1941

Serial No.
393,138

Fig. 1.

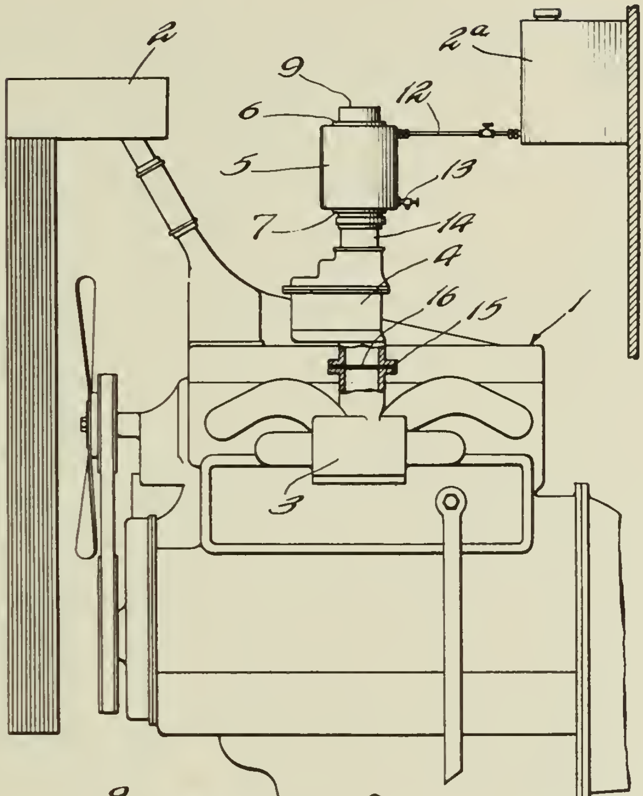
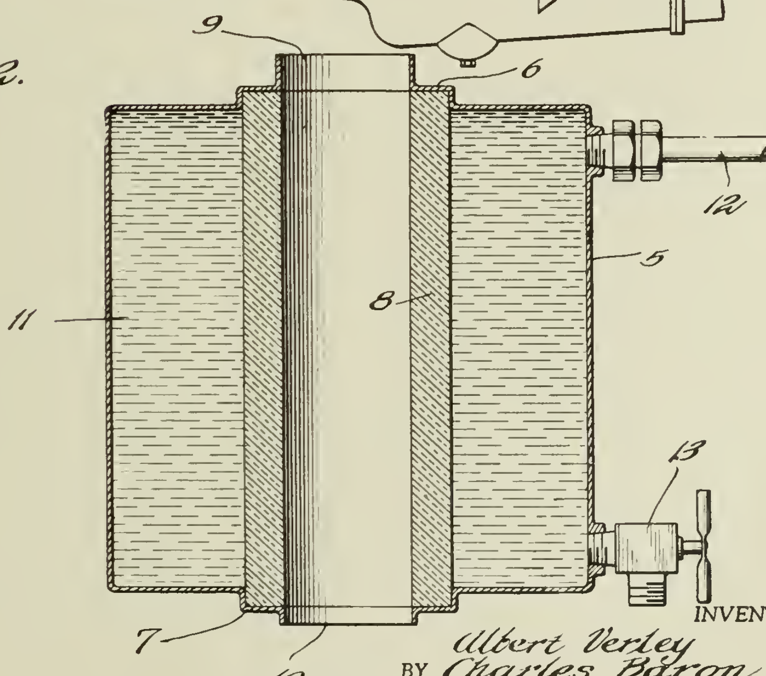


Fig. 2.



INVENTORS
Albert Verley
BY Charles Baron
Theodore W. Miller ATTY.

Published June 15, 1943 Serial No. 395,494

ALIEN PROPERTY CUSTODIAN

PROCESS AND DEVICE FOR OBTAINING AN APPEARANCE OF RELIEF IN THE PROJECTION OF STILL OR MOVING IMAGES

Louis Lumiere, Bandol, France; vested in the Alien Property Custodian

Application filed May 27, 1941

My invention concerns a device for obtaining the appearance of relief in the projection of still or moving images, wherein a reflecting surface is interposed between the projection apparatus and the screen so that the image is formed on the latter after being reflected by the said surface.

According to my invention, the surface of the screen or of the reflecting surface is curved, cylindrical or spherical according to the case, and application is made of the principle of the reverse return of the light rays, in order to observe the projected image and correct the distortion produced by the curved surface. The image formed on the screen, after the rays have been once reflected by the mirror, is sent back to the eyes of the spectators after a second reflection by the said mirror, as a result of the reverse return of the light rays.

According to a preferred embodiment of my invention, the screen is spherical and the reflecting surface is a plane mirror inclined at 45° with respect to and in the path of the light rays.

According to another embodiment, the screen is plane and the mirror is cylindrical.

The description which follows with regard to the appended drawing given by way of example not inclusive of all cases will allow a thorough understanding of how my invention can be embodied, those particularities which appear on the drawing as well as in the specification being, of course, a part of it.

Fig. 1 is a plan, diagram view of the first embodiment comprising a spherical screen.

Fig. 2 shows another embodiment comprising a plane screen and a cylindrical mirror.

On Fig. 1 can be seen at **1** a diffusing spherical screen on which the projection apparatus **2** forms an image, after reflection by the plane mirror **3** inclined at 45°. This image is observed, as a result of the reverse return of the light rays, after a second reflection by the mirror **3**, by the spectators situated at **4** in the vicinity of the projection path.

The appearance of plasticity is remarkable.

On the other hand, the distortion of the image which would be very great if it were observed directly on the spherical screen is completely corrected by the reflection on the mirror **3**, in the reverse return of the light rays.

A sphere the radius of which is approximately equal to the height of the projected image may be used. The screen is but a part of the surface of this sphere, for example the spherical cap bound by the side of the inscribed equilateral triangle. Practically, it may be realized for instance by means of lune-shaped strips of veneer assembled together, the strips bearing a coat of diffusing white paint or else an aluminum paint.

In the embodiment shown in Fig. 2, the diffusing screen **1** is plane, but the mirror **3** is cylindrical. The image projected on the screen **1** is formed thereon only after reflection on this mirror and the spectators observe it after a second reflection by the same mirror which corrects the deformations resulting from the first reflection.

It is difficult to construct correct cylindrical mirrors of large sizes, but substantially defectless plane mirrors are now to be found on the market, and one of the features of my invention consists in the obtention of the required cylindrical mirrors by initially utilizing plane mirrors and deforming them elastically in order to curve them along one of their dimensions. As the curvature radius of the mirrors used is large (of a magnitude of several meters which corresponds to a rise of the order of one centimeter for a mirror the side of which is approximately one meter) it is easy to obtain this elastic deformation. To this effect, it is advantageous to use very thin mirrors, or, better still, tempered mirrors which possess the property of being able to resist, without breaking, deflections from four to five times greater than non-tempered mirrors.

It is of course obvious that the embodiments which have just been described have been given only by way of example and that they could be altered without, by so doing, departing from the scope of my invention. For instance, the spherical screen of Fig. 1 could be replaced by a cylindrical screen.

LOUIS LUMIERE.

PUBLISHED

JUNE 15, 1943.

BY A. P. C.

L. LUMIERE

PROCESS AND DEVICE FOR OBTAINING AN APPEARANCE OF RELIEF IN THE PROJECTION OF STILL OR MOVING IMAGES

Filed May 27, 1941

Serial No. 395494

Fig: 1

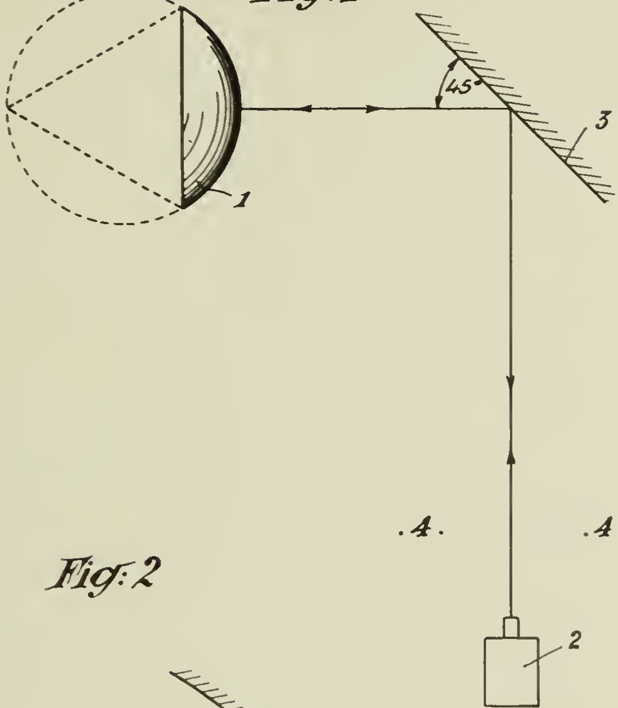
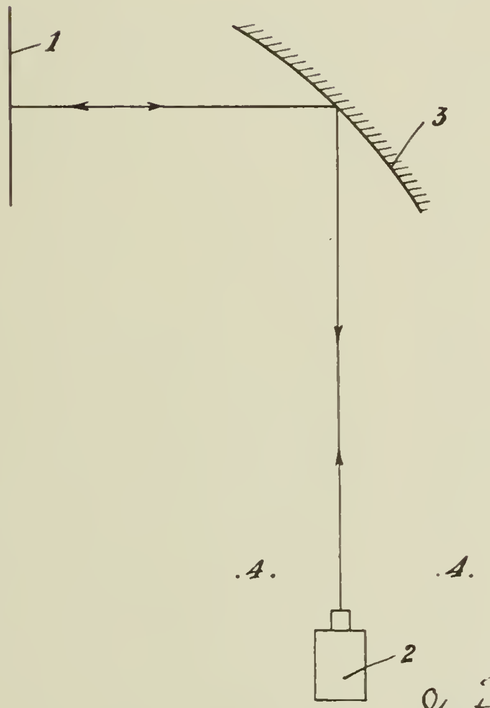


Fig: 2



Inventor
Louis Lumiere
By
Watson, Cole, Grindle & Watson
Attorneys

Published June 15, 1943

Serial No. 395,450

ALIEN PROPERTY CUSTODIAN

AUTOMATIC SLICING LATHES

Georges Emile Cuttat, Paris, France; vested in the Alien Property Custodian

Application filed May 27, 1941

The object of the present invention is an automatic lathe with fixed head stock, comprising a number of members suitably cooperating for forming various manufactured articles starting from a bar with round, square or other cross-section.

The various members have been designed with the view of avoiding all lateral stresses in all the parts, the transmission being effected from the control member (cam or other) to the controlled member in one single plane perpendicular to the axis of the control member.

The cams may be mounted in a manner to facilitate their replacement. They may be fixed to two shafts perpendicular to one another.

The main cam shaft and its controls may be arranged on the front side of the lathe, thereby greatly facilitating their access.

Other characteristics of the automatic lathe according to the present invention will appear from the following specification of a machine chosen by way of example and shown on the joined drawings, in which:

Figure 1 is a front elevation,

Figure 2 is a side elevation, from the motor side,

Figure 3 shows a detail of the cam-shaft coupling,

Figure 4 is a rear elevation,

Figure 5 is a side view with a section through the carriages, and

Figure 6 shows an alternative control of the front carriage moving longitudinally.

The lathe is driven from an electric motor 1 mounted in a cradle 2 which may oscillate about pivot 3 fixed to the cup-shaped frame member 4 (Figure 2). The motor 1 drives through the means of belt 5 the main shaft 6 which sets up the independent rotations controlling the spindle-carrying head stock, the cam shaft, the drilling; the inside screw cutting and other devices, the rotations of these various parts remaining independent from one another.

Shaft 6 controls directly, over belt 7, the rotation of the spindle carrying shaft 8.

Said shaft 6 is specially supported by a movable bearing 9 which may be rapidly dismounted and thus permits the introduction or eventual replacement of belt 7 without requiring a dismantling of any other part. It is thus possible to use an endless belt.

A pulley 11 keyed to shaft 6 drives, over a belt 12, another pulley 13 driving an endless screw 14 acting, over suitable gears forming a variable speed device, on a pulley 15 driving over belt 16 the endless screw 17 meshing with a gear drilled in 18 and keyed to the cam shaft 19.

On the other hand, motor 1 may drive, over a belt 21 (Figure 2) a bevel gear 22 acting, over pulleys 23, 24 and belt 25, upon the shaft of the endless screw 17. On this shaft is interposed a friction cone clutch 26 permitting, by means of a lever 27, to couple with the screw 17 either of the drives coming from motor 1, at will, and thus to cause the cams to rotate faster during the non-working periods.

The shaft 19 carrying the cams 27 (detail on Figure 3) is formed of two portions with a certain interval between their ends and connected by a coupling muff 28 according to the French patent application filed August 1-st, 1939, by Société de Manufacture de Machines du Haut-Rhin, for "Device for coupling two shafts in line." By moving this coupling muff 28, it is possible to set free the interval between the shaft ends for extracting or inserting the cams 27 when these are being replaced by others.

The position of these cams 27 and the drive of the working carriages have been especially designed with the view of avoiding all transverse stresses on the axes and levers.

In order to obtain this result in all cases, the drive of the longitudinal displacements with respect to the machine axis is effected by a cam shaft member 31 perpendicular to the main cam shaft 19, the connection of both shafts being effected by a bevel gear 32 with spiral teeth. The cams of this perpendicular shaft are referred to as 33.

The machine described and illustrated as a non-limitative example comprises five tool-carrying carriages 34, 35, 36, 37 and 38 and an adjustable stop 39 (Figures 4 and 5). One of the tool carrying carriages, 34, is shown as comprising two crossed slides. The middle slide may move longitudinally with respect to the lathe axis by sliding in a lower slide fixed to the lathe bench, its movement being controlled by a lever 44. On this middle slide and perpendicular to it is arranged an upper slide controlled by means of a lever 45 and ensuring the required position of the tool during the work. The connection of this lever 45 with the cam shaft is effected over the connecting rod 46 and an intermediate lever 47 resting on the cam 48; due to this arrangement, the stresses are transmitted from cam to tool in one single plane.

On the detailed Figure 5, the carriage 35 has been shown as being capable of a single transverse motion with respect to the lathe axis, but

it could also, as shown in Figure 6, be realised with two crossed slides, similarly to carriage 34. In this case, the lever for longitudinal motion would be the only member to be stressed not in a single plane, since the drive is taken off the cam by lever 42 while the push on the slide is set up by lever 43. The required precision of the motion is obtained by a rigid mounting of levers 42 and 43 on the axis 41 in order to suppress torsion stresses. The transverse setting of the tool-carrier is effected by lever 49.

The tool carrying carriages 36, 37 and 38 are also provided with a direct drive and the transmission stresses between the roller resting on the cam and the push point on the slide are all in one same plane, the transmission running over levers 50, 51 and 52 resting on the cams, over the intermediate connecting rods 53, 54 and 55, and finally over levers 56, 57 and 58 driving the carriages on their slides. Carriage 37 is the only one provided in addition with an intermediate lever 59 and a connecting rod 60, without, however, changing whatsoever in the novel principle relating to the transmission of the driving forces.

Apart from the tool carrying carriage, the machine may be fitted in addition with devices for forming the end of bars, with devices for the various simple or composite drilling, threading and boring operations, according to the particular uses of the machine, and, eventually, with auxiliary apparatus for drilling, threading and other operations, supplied by transport arms.

GEORGES EMILE CUTTAT.

PUBLISHED	G. E. CUTTAT	Serial No.
JUNE 15, 1943.	AUTOMATIC SLICING LATHES	395,450
BY A. P. C.	Filed March 27, 1941	2 Sheets-Sheet 1

Fig. 1

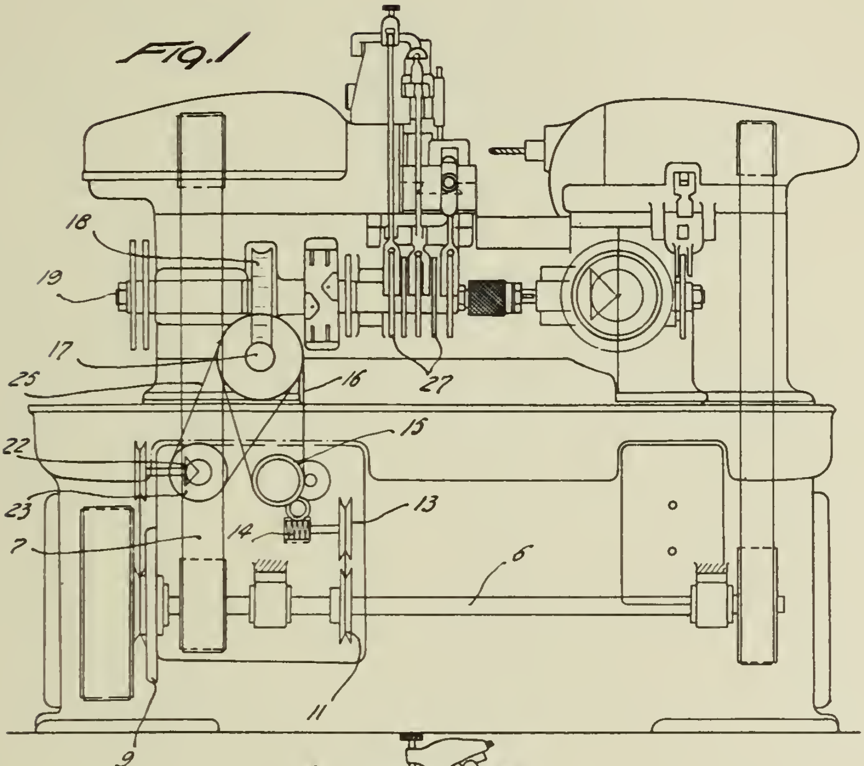
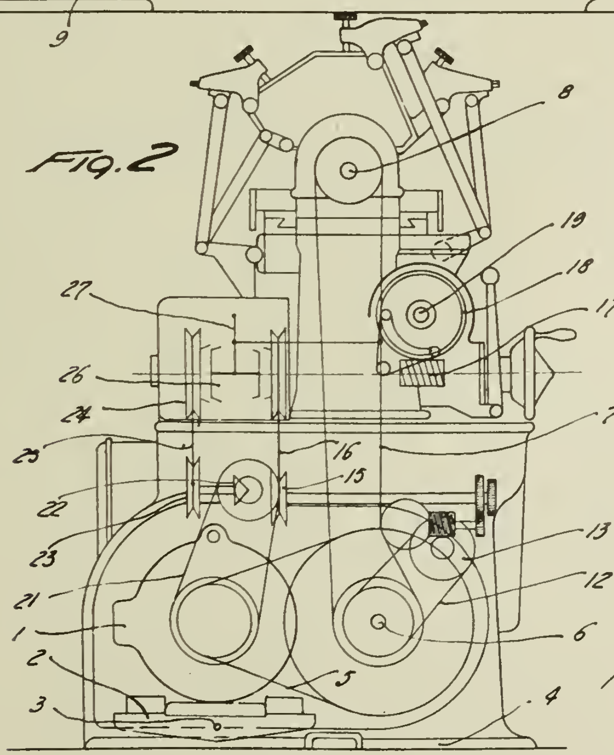


Fig. 2



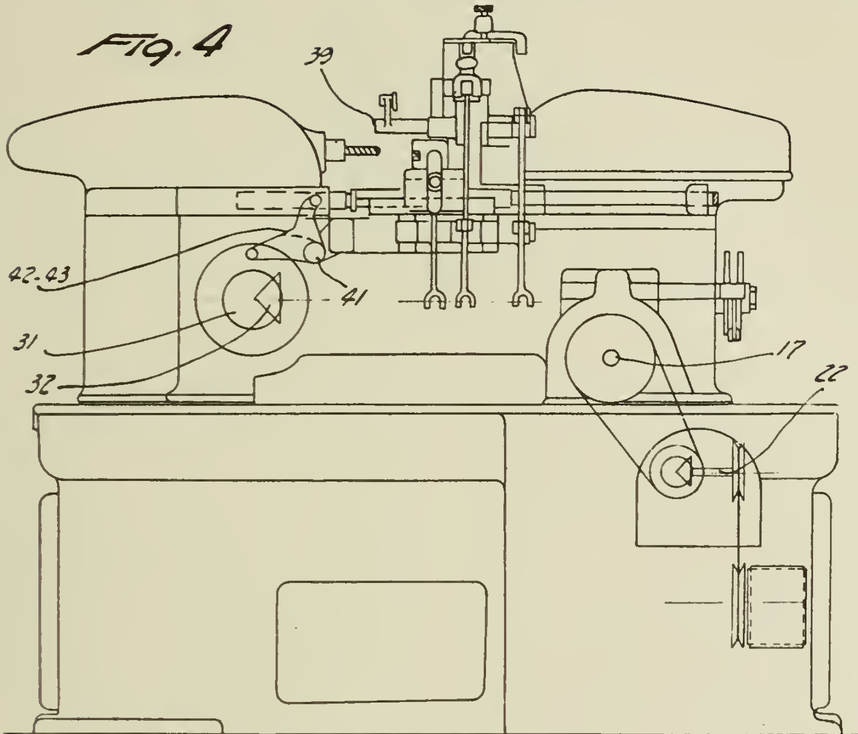
Inventor:
G. E. Cuttat,
By E. F. Wenderoth
Atty

PUBLISHED
JUNE 15, 1943.
BY A. P. C.

G. E. CUTTAT
AUTOMATIC SLICING LATHES
Filed March 27, 1941

Serial No.
395,450
2 Sheets-Sheet 2

Fig. 4



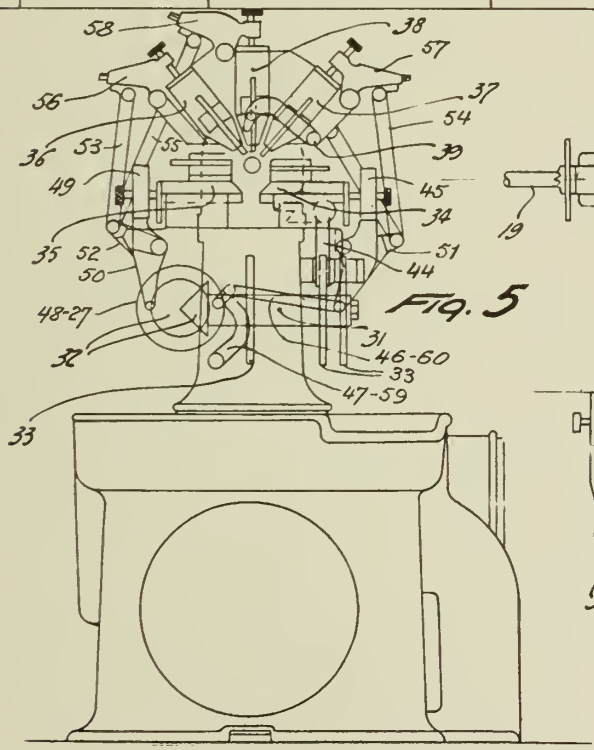


Fig. 5

Fig. 3

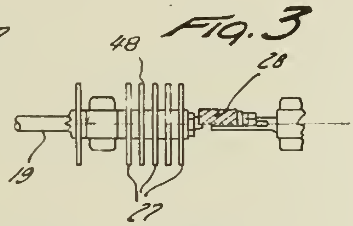
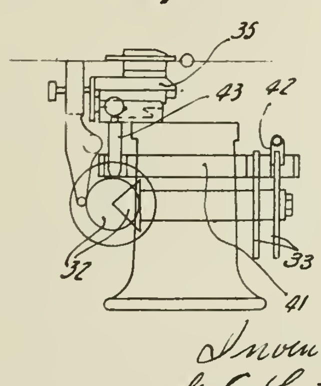


Fig. 6



Inventor:
G. E. Cuttat,
By E. F. Wenderoth Atty

Published June 15, 1943 Serial No. 395,451

ALIEN PROPERTY CUSTODIAN

LATHES FOR METAL JOBS

Georges Emile Cuttat, Paris, France; vested in the Alien Property Custodian

Application filed May 27, 1941

The present invention concerns lathes for metal jobs and especially automatic and half-automatic lathes with a fixed or movable head stock carrying the job forming bar and controlled by a cam.

The object of the invention is a device for "setting" the job in position, with multiple spindles, of the type in which any of said spindles may be set into the work position by a rocking movement followed by a longitudinal displacement.

For this, the spindles are mounted in a rocking body permitting to bring each of them into working position. When this working position has been attained, the corresponding spindle receives its longitudinal motion from a control lever actuated by a cam.

According to the present invention, the rocking spindle carrier comprises at its front side a shield containing the main casing of the upper part of the machine and protecting the latter against introduction of any foreign bodies such as metal strips, oil etc. into the mechanism.

The spindles may be caused to rotate each separately or all together by a drive mounted on the pivoting axis, and the rotation of the spindles may also be possible in both directions.

Other characteristics of the present invention will become apparent from the following description of an embodiment chosen by way of example and illustrated on the joined drawings, in which:

Figure 1 is an elevation in section along the axis,

Figure 2 is a transverse section substantially along line A—A of Figure 1,

Figure 3 is an outside view in front elevation, and

Figure 4 is a transverse section substantially along line B—B of Figure 1.

The apparatus comprises essentially a spindle-carrying body **1** rocking about axes **22**, **23** carried by supports **2**, **3** in a bed **4** rigidly fixed to the lathe bench fitted with the apparatus.

The body **1** is provided with a number of tool-carrying spindles arranged along a circle, the centre of which is constituted by the axis **22**. **23**. The number of spindles may, of course, be varied at will. Three spindles have been shown here, referred to as **5**, **6** and **7**. The spindles may move longitudinally in bearings of body **1**.

On the spindles are fixed a number of primary driving pins **8** and secondary driving pins **9**, sliding along guiding bars **10**. The pin **8** transmits to the spindle its longitudinal displacements. For this, it is actuated by an arm of lever **12** pivoted in **24** to the frame and receiving itself its motion from the cam **25**.

The return motion of the spindles in the direction opposite to that into which they are driven by lever **12**, is obtained by a spring **11** (Figure 2) parallel to the bar **10**.

The adjustment of the spindle stroke is obtained by the cooperation of the secondary pin **9** with the micrometer screw **13** (Figure 1). In the adjusted position, the pin **8** and the secondary pin **9** are blocked by screws **14** (Figure 2).

At its front part, the spindle carrying body **1** has substantially the form of a disc forming a sort of convex shield **1'**, the curvature of which is extended by the upper casing **26** of the apparatus. The arrangement formed by the shield of the body and by the upper casing constitutes a sort of block protecting the machine from metal strips or any other foreign bodies that might be projected upon the machine. The upper casing **26** is mounted on hinges or fixed by screws, thereby permitting the visit of the inside and an easy access to all screws and stops ensuring the adjustments of the longitudinal and transverse motions.

If the spindles are to be rotatable, the references **5**, **6** and **7** (Figure 1) are only directed to the bushings of the inner spindles **35**, **36** and **37** which are mounted on not shown bearings.

On any one spindle is keyed a gear **29** integral with a muff **30** set on the fixed pivoting shaft **23**. On this muff are freely mounted two pulleys **31**, **32** driven in rotation in opposite directions by not shown belts. Between the pulleys **31** and **32** is arranged a clutch member **33** of a known type, slidable without rotation on muff **30**. The sliding motion of this member is controlled by a not shown clutch lever. It is clear that according as to whether the member **33** is pushed towards the right or towards the left, the spindle will rotate in one direction or the other, thus permitting to cut right or left handed screw threads.

The muff **30** is supported at the rear by a bearing **15** movable so as to clear a space *a* between itself and the muff, to allow the insertion of the driving endless belts.

The rocking motion of the oscillating body is obtained by means of a known device. The body carrying a shoulder in the form of a fork **34** is provided with a connecting rod **17** actuated by a bent lever **16** pivoting about a point **35** fixed to the machine. The construction is such that the mean contact point on the cam and the point of application of the oscillation force remain in a same plane, thereby excluding any lateral reaction and thus permitting to obtain full precision when setting the apparatus in position for effecting the required centering by alinement of the spindles with the bar to be worked. Stops **36** and **36**bis serve to complete the centering of the spindles. The invention is obviously not limited exclusively to the form described and illustrated by way of example, and certain alterations may of course be performed, such as the provision of direct acting levers etc., without departing from the frame of the invention.

GEORGES EMILE CUTTAT.

PUBLISHED	G. E. CUTTAT	**Serial No.**
JUNE 15, 1943.	LATHES FOR METAL JOBS	**395,451**
BY A. P. C.	Filed March 27, 1941	3 Sheets-Sheet 1

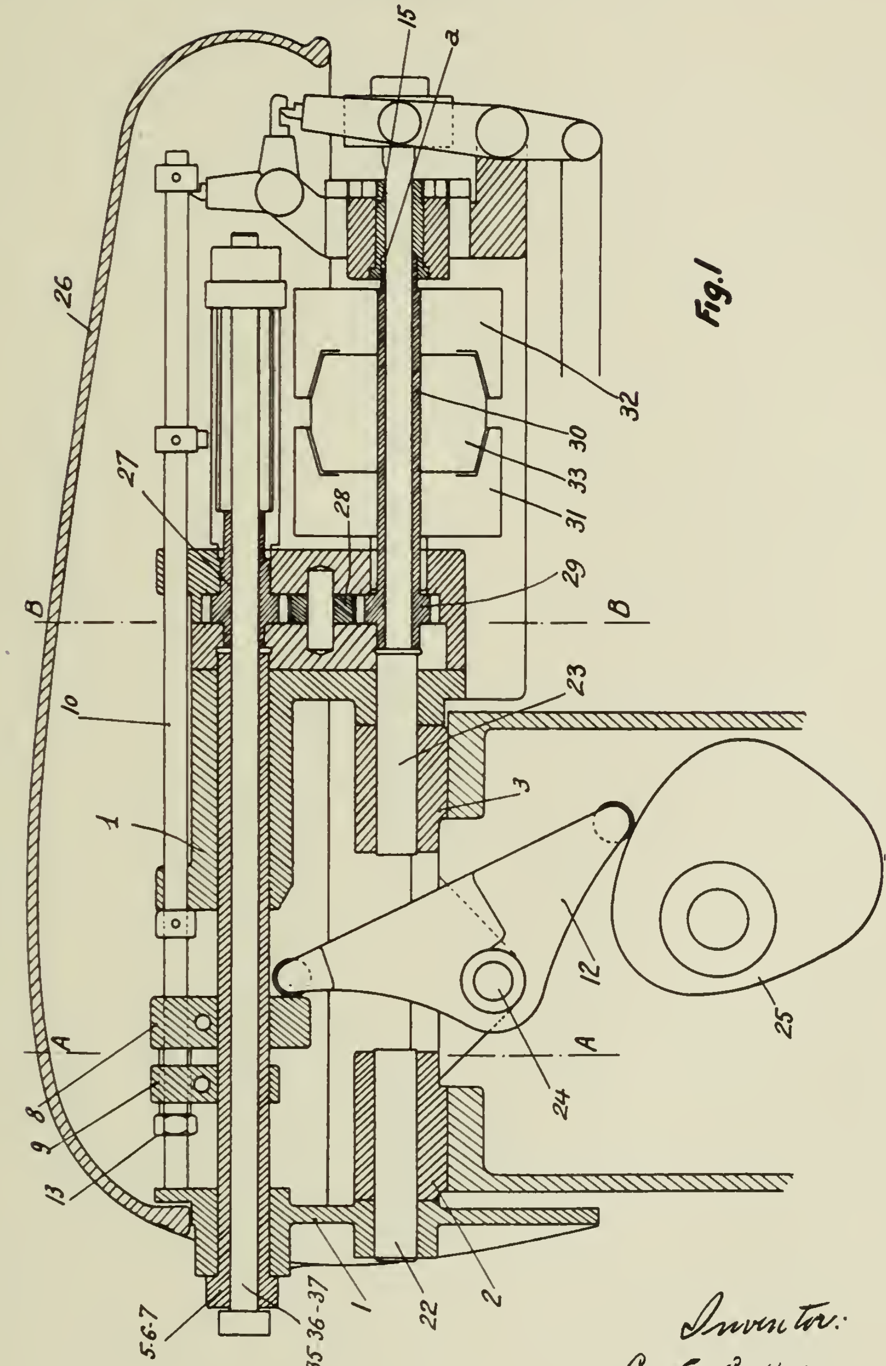


Fig. 1

Inventor:
G. E. Cuttat,
By E. F. Wenderoth
Atty

PUBLISHED
JUNE 15, 1943.
BY A. P. C.

G. E. CUTTAT
LATHES FOR METAL JOBS
Filed March 27, 1941

Serial No.
395,451
3 Sheets–Sheet 2

Fig. 2

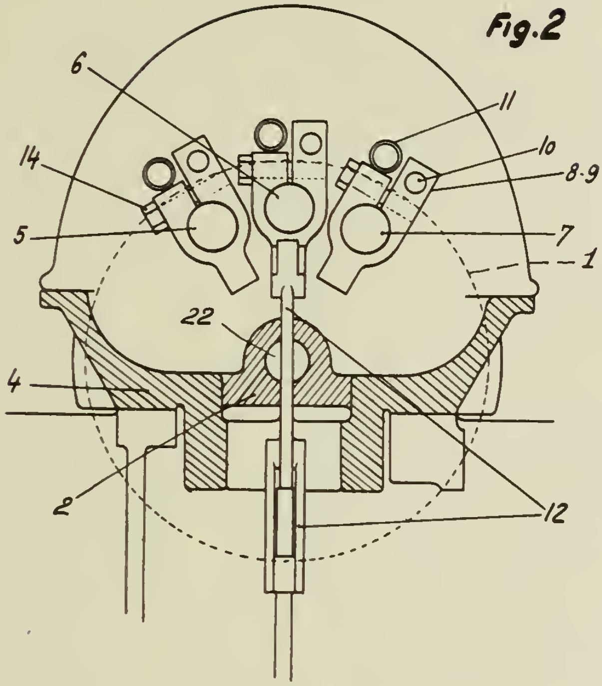
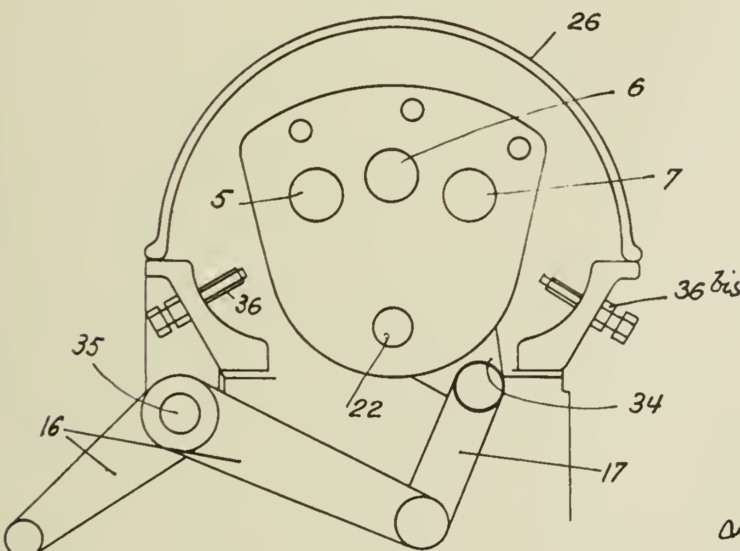


Fig. 4



Inventor:
G. E. Cuttat
By E. F. Wenderoth
Atty

PUBLISHED
JUNE 15, 1943.
BY A. P. C.

G. E. CUTTAT
LATHES FOR METAL JOBS
Filed March 27, 1941

Serial No.
395,451
3 Sheets-Sheet 3

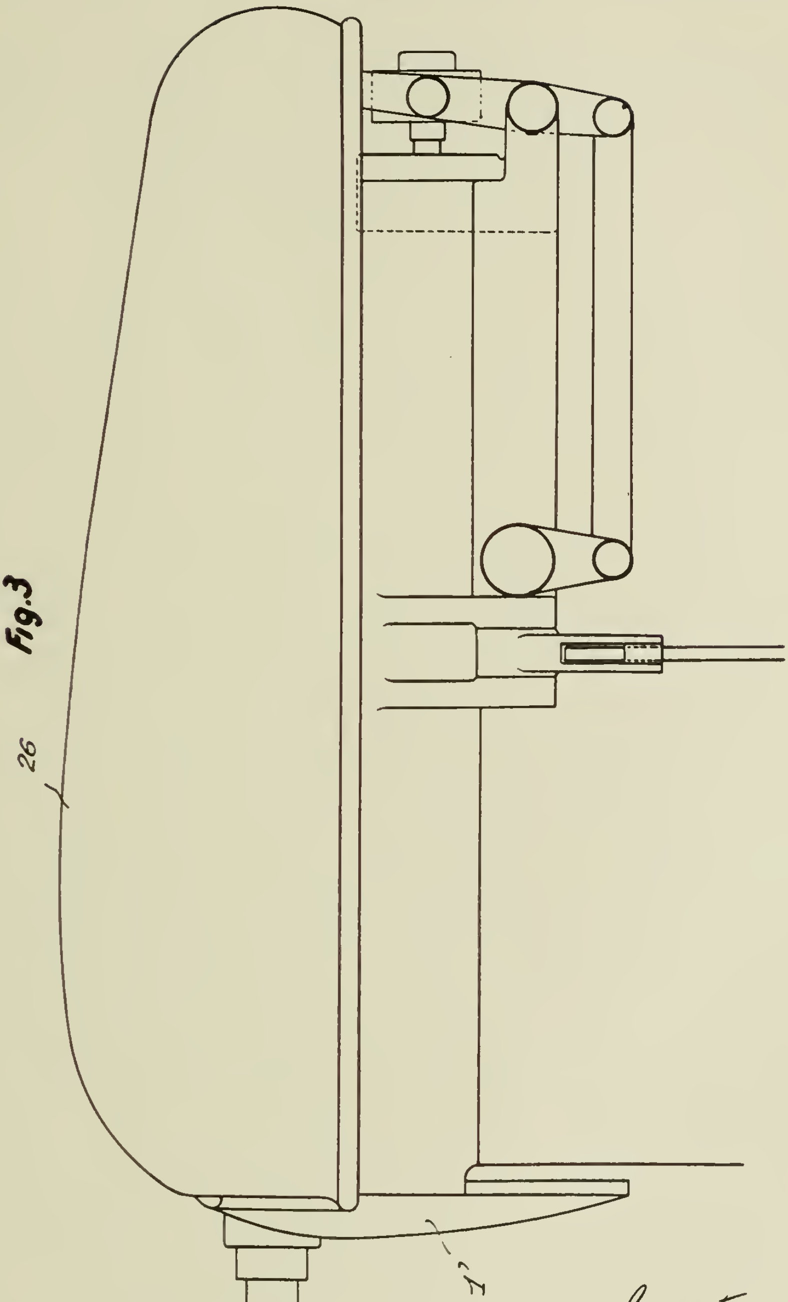


Fig. 3

Inventor:
G. E. Cuttat,
By E. F. Wendroth
Atty

Published June 15, 1943

Serial No. 399,706

ALIEN PROPERTY CUSTODIAN

ARRANGEMENT FOR ULTRA SHORT WAVES

Walter Dällenbach, Berlin W 35, Germany;
vested in the Alien Property Custodian

Application filed June 25, 1941

The invention refers to an arrangement for ultra short waves, especially of those of a wave length of less than 1 metre, for the transition of energy from a concentric energy line to a parallel Lecher-system consisting of wires or straps, or vice versa for the transition from a parallel Lecher-system consisting of wires or straps (in the following named as Lecher-system) to a concentric energy system.

In regard to ultra short wave devices, especially for such of a wave length of less than 1 metre the transition from a concentric energy system to a Lecher-system or vice versa is necessary for different purposes, f. i. for coupling a push-pull diode for the purpose of receiving or for bridge devices at superheterodyne receivers or for the feeding of dipol aerials.

The invention now shows, how it is possible to make the changing of the energy from one system to the other in a simple way and to reach a firm coupling between the two systems. According to this invention same will be reached by interrupting the inner conductor of the concentric energy system and connecting same to the Lecher-system, the free ends of same at the interruption point being led through an opening in the outer conductor. If on the concentric energy system a standing wave is found, it is preferred to place the interruption point of the inner conductor at the point of a current loop (and at the immediate neighbourhood of same). Thus all the current of the concentric energy system is being forced to flow as well through the Lecher-system. The coupling of the two systems then will be especially firm.

Special explanations of the arrangement according to the invention will be given in the examples of construction as per drawings 1 to 9 and the description made thereof.

Fig. 1 represents an arrangement which is not favourable and will be improved by the invention.

Fig. 2 shows an embodiment of the invention lateral of a concentric energy line a Lecher-system consisting of parallel wires or straps being coupled.

Figs. 3*a* and 3*b* show the same embodiment in side elevation and longitudinal section.

Figs. 4*a* and 4*b* show another embodiment of the invention in side elevation and longitudinal section.

Figs. 5 and 6 show some other embodiment of the invention.

Fig. 7 shows the lateral coupling of an antenna to a concentric energy line.

Figs. 8 and 9 show some singularities of the invention.

Fig. 1 shows f. i. the usual coupling of a push-pull diode to a concentric energy system for the purpose of receiving as being used up to now. Reference numerals **1** and **2** refer to the concentric energy system being connected to a receiving aerial. This concentric energy system will be transferred into the Lecher-system **4, 5** at the point **5** as may be seen from the drawing. At points **9** and **10** the anodes, at point **8** the leading-in of the cathode and at **6** and **7** the hot heating wire of a (not drawn) duo-diode are coupled. The examination of this arrangement shows that the coupling of the concentric energy system to the Lecher-system is rather loose and that for this reason it is difficult to transfer the energy of the concentric system to the diode. Besides, the construction of the point of changing from one system into the other as per Fig. 1 is not made in a satisfactory manner.

In Fig. 2 the outer conductor of the concentric system is signed **11** and the inner conductor is signed **12**. To these the Lecher-system **13, 14** has to be connected. The inner conductor **12** is interrupted at the point **15**. By the interruption two free ends **16** and **17** are resulted. These will be connected gavanically to the Lecher-system **13, 14** through an opening in the outer conductor. For the Lecher-system small straps having the broad sides turned to each other can be used or otherwise wires may be used. The Lecher-system may also be constructed in such way that it consists of straps near the point of interruption which gradually reduce to wires or vice versa which near the interruption point consists of wires which gradually extend to small straps.

In the case that on the concentric energy system a standing wave is existing and at the interruption point the coupled Lecher-system having a length of $\lambda/2$ resp. equivalent to $\lambda/2$, the proportions and conditions of the concentric energy system must be unaltered, that is the inner conductor of the concentric energy system must be such as if it is not interrupted. In case the inner conductor is interrupted especially at the point of a current loop (and its near neighbourhood), the current of the $\lambda/2$ long parallel Lecher-system has the most possible voltage so that at coupling the diode in its voltage loop a sufficient load is being reached. The coupling point of the anodes of the (not drawn) duo-diode are signed **19, 20**. The tuning of the parallel Lecher-system **13, 14** to the wanted wave length either

can be done by a condenser short circuit bridge device or by a displacing body **21** which is being shifted more or less far between the parallel wires of the Lecher-system.

Figures 3*a* and 3*b* (Fig. 3*b* is a section of Fig. 3*a* along the line $x—x$) show in two views the construction of the point in question as per invention between the concentric system **11**, **12** and the Lecher-system **13**, **14** consisting of two parallel wires. The opening **18** being arranged in the outer conductor **11** and having f. i. oval shape will be chosen purposely of such size that the capacity resistance between the wires **13**, **14** and the outer conductor is big compared with the wave resistance of the Lecher-system.

In case the Lecher-system consists of two flat straps, a mechanical connection between the field free outer side of the Lecher-system and the outer side of the outer conductor of the concentric energy system can be used, where the shape of the opening is suitable chosen without altering much the oscillation state on the conductor. For the purpose of better mechanical support of the straps of the Lecher-system the single straps can be fastened by angle brackets upon the outer conductor. The opening resp. the angle brackets should be formed in such way that metallic connections between the Lecher-system and the outer conductor of the concentric energy system only are made at the fieldless outer side of the outer conductor resp. at that of the Lecher-system. In the drawings 4*a* and 4*b* (4*b* is a section along $x—x$ in Fig. 4*a*) such an example of the arrangement is shown. Also here the numerals **11**, **12** resp. **13**, **14** mean the concentric energy system resp. the Lecher-system. The opening arranged in the outer conductor is signed **18**. The angle brackets **22**, **23** are fastened with the help of screws at the straps **13**, **14**.

At the example of arrangement as per Fig. 2 the concentric energy system is lengthened beyond the interruption point about nearly the length of $\lambda/2$. For closing the energy system, $\lambda/4$ long pistons can be used as is described in the U. S. A. Patent 2,226,479. Thus it is possible that the mechanical connection between the conductors of the concentric energy line is being arranged near a current node. By this the influence of transition resistances resulting of the change from one system to the other can be avoided. Such tuning piston eventually makes it possible to compensate reactances appearing at the interruption point.

The closing of the concentric energy system also can be made immediately behind the interruption point as Fig. 5 is showing. Here **11**, **12** mean the concentric system, **13**, **14** mean the Lecher-system and **18** means the opening being provided in the outer conductor of the concentric energy system. To get also in this case a second tuning device, as per Fig. 6, between the inner conductor **12** of the concentric system **11**, **12** and the closing plate **25** a variable capacity **26** (trimming condenser) can be provided by which the reactances appearing at the interruption point of the inner conductor **12** can be compensated.

The use of the coupling of a Lecher-system to a concentric energy system is not limited in respect to the special use of the coupling of a push-pull diode to a concentric energy system, but the examples of arrangement shown in the drawings f. i. can be used quite generally for coupling a receiving diode to a concentric energy system. Other devices may be coupled in the same manner too.

The use of the device as per invention at the coupling of surface or box-like radiators (according f. i. to the application Serial Number 129,218) to an energy system shows special advantages. At these antennas the oscillation energy is transmitted immediately from hollow space like or boxlike formed metallic surfaces. Up to now it was usual to load the concentric energy system feeding the radiators in such manner that the outer conductor at the point of a current loop (and in the immediate neighbourhood of same) was interrupted over a periphery angle of 100°. At this interruption point the radiating surface is coupled which contains slitlike openings, called coupling slits. One part of the current flows from the coupling slit to the radiator and excites the latter. This part of current is rather small. If however the inner conductor is interrupted by adding a Lecher-system according to the invention, it is possible to force practically the whole oscillation current to flow to the radiator. The radiator load thus is much bigger.

For the coupling of a boxlike surface radiator a device is constructed as shown f. i. in Fig. 7. The concentric energy system is signed **11**, **12**, the Lecher-system is signed **13**, **14** and the surface radiator being coupled to the concentric energy system over the conductor **13**, **14** bears the numeral **28**. The Lecher-system feeding the radiator **28** is surrounded by a protecting pipe **27** which serves for the purpose of avoiding radiating and at the same time for better mechanical support of the surface radiator. On the surface **29** of the radiator **28** an opening **30** (coupling slit) is provided through which the oscillation energy is flowing from the concentric system to the radiator. In choosing a suitable arrangement and shape of the coupling slit **30** it can be reached that the load which the radiator means for the Lecher-system, can be varied essentially. Fig. 8 represents an arrangement of the coupling slit **30** being provided in the surface **29** of the radiator **28** for loose coupling between the Lecher-system **13**, **14** and the surface radiator **28**, being formed boxlike. A firm coupling between the Lecher-system **13**, **14** and the radiator **28** is being reached by the coupling slit **30** as is shown in Fig. 9. Purposely in both cases the coupling slits **30** being provided in the surface **29** of the radiator **28** have to be shaped in such way that a variation of the oscillation state on the surface of the radiator will not take place.

A further possibility of use is given by the exciting of hollow space resonator with the help of such parallel Lecher-systems in any current loop.

In regard to the example of using the device according to Fig. 7 only one surface radiator (boxlike radiator) is coupled to the concentric energy system. Of course also more than one radiator especially surface radiator (boxlike radiator) can be coupled to the concentric energy system, each radiator with the help of a Lecher-system. In this case (i. e. standing waves on the concentric energy system) the interruption points of the concentric system to which the Lecher-systems are connected may be arranged in or near to a current loop. For getting the different radiators being excited in the same phase the distance of the single interruption points are to be chosen like the wave length resp. like a whole number of the wave length. The length resp. the wave resistance of the Lecher-system leading to the different radiators can be chosen differently, they may be chosen however in regard to the different

loads in such way that at the interruption points a resistance as small as possible especially ohmic resistance appears which is practically zero. If especially a running wave on the Lecher-systems resp. in the largest part of them is wanted it can be reached in this way that between the interruption point and the load (radiator) one or more $\lambda/4$ long transformation pieces may be coupled in the Lecher-system as it is necessary for running waves to adapt the resistance at the interruption point to the wave resistance of the concentric energy system.

WALTER DÄLLENBACH.

PUBLISHED
JUNE 15, 1943.
BY A. P. C.

W. DÄLLENBACH
ARRANGEMENT FOR ULTRA SHORT WAVES
Filed June 25, 1941

Serial No. 399,706
2 Sheets-Sheet 1

Fig. 1

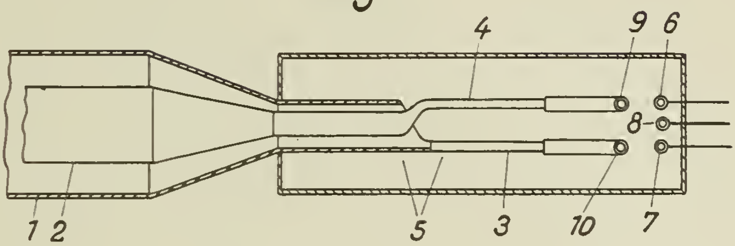


Fig. 3a

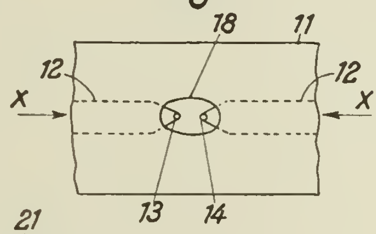


Fig. 2

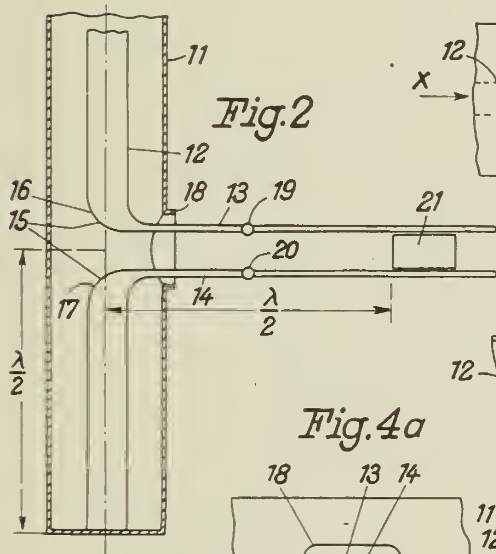


Fig. 3b

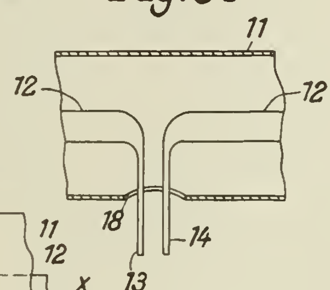


Fig. 4a

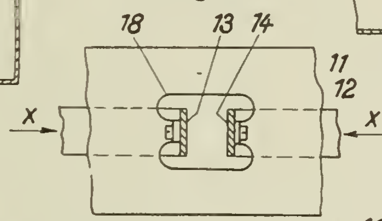
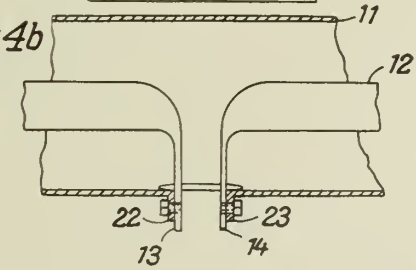


Fig. 4b



Inventor:
WALTER DALLENBACH,

BY Robert B. Pearson
ATTORNEY

PUBLISHED
JUNE 15, 1943.
BY A. P. C.

W. DÄLLENBACH

ARRANGEMENT FOR ULTRA SHORT WAVES

Filed June 25, 1941

Serial No.
399,706

Fig.5

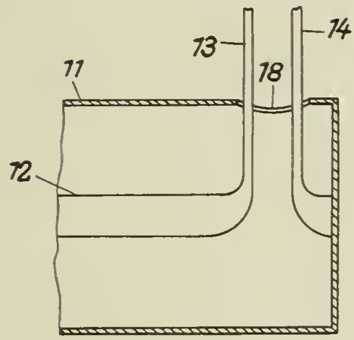


Fig. 6

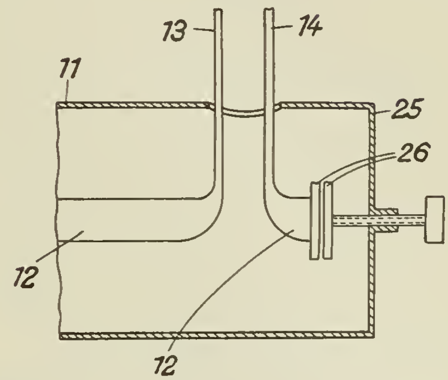


Fig.7

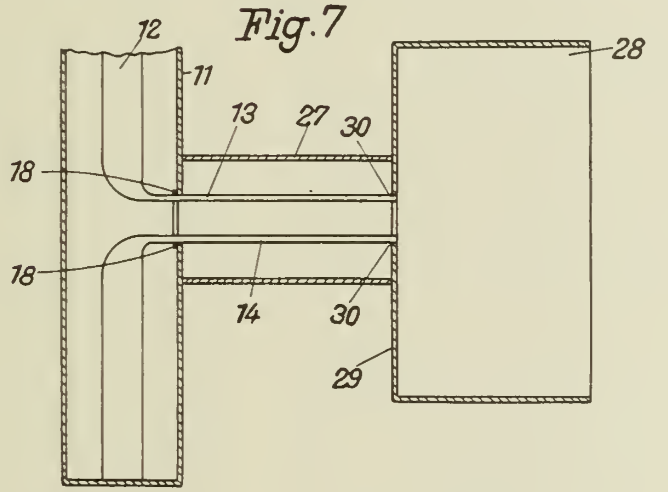


Fig.8

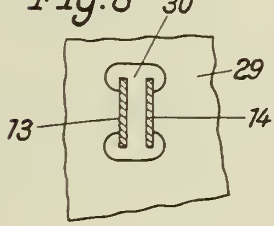
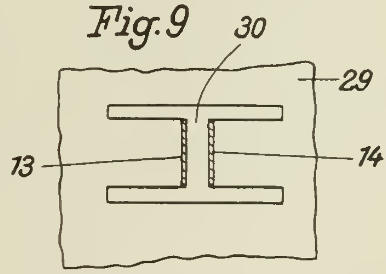


Fig.9



Inventor:
WALTER DALLENBACH,

BY Robert B Larson
ATTORNEY

Published June 15, 1943

Serial No. 399,397

ALIEN PROPERTY CUSTODIAN

METHOD FOR CARRYING OUT BASE EXCHANGING PROCESSES

Antonius Foss, Heggeli near Oslo, Norway; vested in the Alien Property Custodian

No Drawing. Application filed June 23, 1941

It is known to use base exchanging materials (zeolites, permutites) for producing salts by exchange reactions. This process has been extensively used for producing nitrate of sodium by reaction between nitrate of lime and chloride of sodium, sea water being utilized as source of chloride of sodium. In this way it has been possible to utilize advantageously the lower contents of chloride of sodium in the sea water, the zeolite causing the necessary increase of concentration which makes the process practically useful.

In all processes of this kind previously known it is presumed that the zeolite after each treatment with a solution of a salt is washed with pure water, for instance by introducing between the consecutive salt solutions layers of pure water, which prevent the solutions from being mixed.

It has now been found that such washing or introducing of layers of pure water is not necessary. The inventor has found that when a uniform passage of the salt solutions and a correct size of granules in the zeolite is secured, the mixing which takes place between consecutive salt solutions is relatively unimportant, even when the specific weights are very different. Mixing does not take place to a degree which causes detrimental impurity of the different solutions.

Example

A system comprising four tubes containing a zeolite layer of 2.8 m thickness and 5.5 cm^2 cross section was treated with sea water for producing sodium zeolite. Then nitrate of lime was introduced without having a layer of pure water between the solutions of nitrate and the sea water.

After this system had been in use for some time and stable conditions had been obtained, it was found that 500 ml of nitrate of lime solution containing 216 g $Ca(NO_3)_2$ after having passed the system had been increased to 682 ml containing the total amount of nitrogen introduced less approximately 4% representing the losses in the process. From this volume of liquid, 682 ml, there is obtained by evaporation and crystallization 100 g nitrate of sodium. The mother lye containing mainly nitrate of lime and nitrate of sodium was returned to the process.

The crystallized nitrate of sodium contained 5% chloride of sodium. By recrystallization, pure nitrate of sodium may be produced without difficulty.

By carrying out the process in this manner the same is very much simplified, as the means necessary for introducing the layer of water, such as valves, tubes and tanks, may be omitted, whereby the plan is considerably simplified and cheaper. One also obtains an increase in capacity of production, as the time and the space necessary for the layer of water are omitted.

The drawback that the product obtained by the first crystallization contains an amount of chloride is of no importance, when the product is to be used as fertilizer. In case a pure salt is desired, this may be obtained by a simple re-crystallization process.

ANTONIUS FOSS.

Published June 15, 1943 Serial No. 399,913

ALIEN PROPERTY CUSTODIAN

ADDRESS PRINTING PLATE

Richard Rose, Berlin N 113, Germany; vested in the Alien Property Custodian

Application filed June 26, 1941

When printing forms, lists, and the like in address printing machines the position of the sheets to be printed is determined by adjustable abutment members. In order to obtain that in spite of the employment of always new type carriers the printing takes place always at the same place of the sheet concerned, also the printing types must be arranged at a certain definite place of the type carrier which is guided in quite a definite manner. It is, therefore, as regards address printing machines, requisite that the type carrier, that is to say, the address printing plate, is in quite a definite reposition relatively to the fixed abutment members in the stamping or impressing machine, as well as in the printing machine.

With address printing plates having at their longitudinal sides guide rims formed by flanging the outer edge of the guide rim is used as abutment for the plate in the stamping or impressing machine, as well as in the address printing machine. Owing thereto, the printing space of the plate is determined by the breadth of the guide rim, the outer edge of which is used as abutment. The thereby conditioned requirement as to maintaining a certain definite breadth of the guide rim is, however, disadvantageous in several respects. Thus, for instance, inaccuracies occurring in the manufacture of the guide rim exert a detrimental effect upon the correct position of the printing plate. Furthermore, it is not possible to provide for an enlargement of the guide rim, for instance, in the case that an enlargement is desired for the reception of insertion. Also if this guide rim is used for the reception of designation riders a deviation of the shape of the guide rim may likewise be desirable.

The present invention relates to an address printing plate consisting of zinc or aluminium or the like and having guide rims formed by flanging of the longitudinal rims, at least one of said rims serving as abutment in order to secure a certain definite position of the stamping or impressing field in the stamping or impressing machine. The invention consists especially therein that in order to obtain the correct position of said field independently of the variable breadth of the guide rim this latter is provided at each of its ends with an incision, the bottom edge of which co-acts with a correspondingly shaped and positioned recess at the receptacle taking up the plate, whereas, between the rim edge of the guide rim and said receptacle a space is provided. The operator is in this way made independent of the breadth of the guide rim as regards the correct position of the plate. It is even possible to make use of larger, intentionally provided deviations in the breadth of the guide rim in one and the same stamping or impressing and address printing machine without any variation of the place of the type on the printing plate, or of the printing place on the fore-imprint.

Another characteristic feature of the invention is that the guide wall of the plate accumulator is provided with ribs engaging the incisions of the address plate.

The invention is illustrated diagrammatically and by way of example on the accompanying drawing on which Figure 1 is a plan of a printing plate designed according to this invention. Figure 2 is a transverse section in the plane II—II of Fig. 1. Figure 3 shows the upper end of the guide wall of a plate accumulator, and Figure 4 is a transverse section in the plane IV—IV of Fig. 3.

The address printing plate illustrated in Figs. 1 and 2 consists of a strip 1 of a material able to be impregnated, as for instance zinc, aluminium or another suitable metal. The longitudinal rims are bent in known manner so as to constitute guide rims 2 and 3. The guide rim 2 is provided with recesses 4 for the reception of riders 5. At each of the two ends of said rim is a separate recess 6, the shape of which differs somewhat from the shape of the recesses 4. Said recesses 6 do not serve for the reception of riders 5, but their bottom edges 7 constitute abutments which co-act with correspondingly located and shaped projections provided in the plate enclosing the form during the stamping or impressing procedure, in such a manner, that the position of the stamping or impressing plate with respect to the printing form is independent of the breadth of the guide rim 2. Corresponding projections are provided also in the plate accumulator of the address printing machine.

In Figs. 3 and 4 is shown by way of example the guide wall 8 of a plate accumulator designed in this way. This guide wall is provided with ribs 9 extending transversely with respect to the plates, the edges 7 of the recesses 6 of the address printing machine contacting with said ribs.

RICHARD ROSE.

PUBLISHED

JUNE 15, 1943.

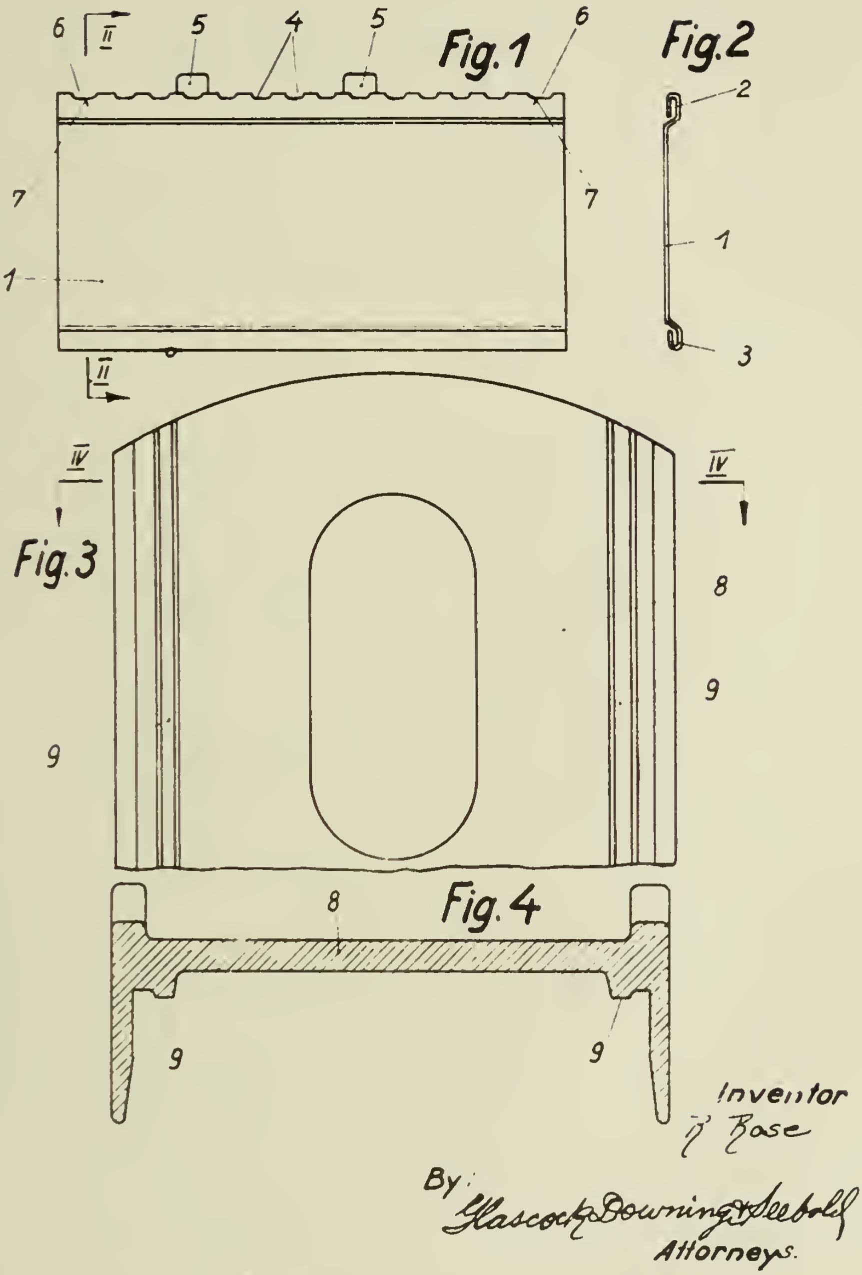
BY A. P. C.

R. ROSE

ADDRESS PRINTING PLATE

Filed June 26, 1941

Serial No. 399,913



Published June 15, 1943 Serial No. 400,874

ALIEN PROPERTY CUSTODIAN

DEVICES FOR SAVING GASOLINE AND IMPROVING THE CARBURIZATION OF EXPLOSION MOTORS OF ANY KIND, THROUGH THE SIMULTANEOUS ADDITION OF OIL VAPOURS AND MOIST AIR

Raoul Ghezzi, Monte Carlo, Monaco; vested in the Alien Property Custodian

Application filed July 2, 1941

The object of the present invention is to provide a device permitting of the simultaneous addition of oil vapours and moist air to the gas mixture usually supplied by the carburettor.

Since humidity is unexplosive and antiscaling, its corrects the action of oil vapours, while these, being inoxidable, escape the inconveniences produced by moist air.

The device object of the present invention essentially consists of a moist air generator, an oil vapour feeding piping, a distribution chamber, a flange inserted between the admission collector and the carburettor where the mixture gasoline-air, moist air and oil vapours is performed.

In the annexed drawings, merely intended to offer a schematic example, not limiting in any way the range of the present invention, of some embodiments of the said invention:

Figs. 1—2—3 show respectively, in longitudinal section, the moist air generator, the distribution chamber and the flange inserted between the admission collector and the carburettor.

Fig. 4 is the view of a flange with the inlet for moist-air and oil vapours mixture disposed in an inclined position.

Fig. 5 is a front view and the section of a flange with a double inlet for the mixture of moist air-oil vapours, being provided for distribution chambers having two outlets.

Fig. 6 is a scheme of the whole assembly.

The moist air generator (Fig. 1) consists of a hollow body **1**, or cup, containing water, provided with air inlet **2**; on the upper portion of this body is provided a circular groove **3** carrying the filtering elements **4**, to which web strips **5** or strips of any other suitable material are suspended for the purpose of carrying water to the upper portion by capillarity. These filtering elements or members are fixed by closing the dome shaped cover **6** having a shoulder **7** corresponding to the cavity of the body **1**.

The piping **8**, which carries moist air into the distribution chamber is fixed onto the generator in the following manner:

The collar of the copper pipe is located in a seat provided for in the cover, being pressed against it by the half-joint **9**. The distribution chamber (Fig. 2) comprises a body **10** bored through by a hole **11**, forming a duct, and on which are mounted: the cock plug **12**, synchronized with the acceleration drive and regulating the quantity of oil vapours and moist air which is to be admitted according to the motor speed, and the cock plug **13**, permitting of the passage of such quantity, actuated by the operator's hand.

Oil vapours and moist air arrive respectively at **14**—**15** and mix themselves in the chamber **16** located on the top of the body **10**. The mixture is then conveyed, according to position of cocks **12**—**13**, through the piping **17**, to flange **18** (Figs. 3—4—5—6) inserted between the admission collector and the carburettor. This flange is provided with two grates **19**—**20**, the one on the carburettor side, the other on the collector side and the piping **17** is ending between them. This piping may be inclined to the longitudinal axis of the flange **18** (Fig. 4). There may be provided two inlets **21**—**21'** for the mixture of oil vapours-moist air (Fig. 6), corresponding to the two outlets of the distribution chamber. As for instance the mounting of the device may be carried out as follows:

(1) The joint **22** for oil vapours feed piping is being fixed onto the tappet cover or the perforated plug closing the filling hole of the engine sump, or at any other suitable place.

(2) The cup is fixed by any suitable means onto the inner wall separating the motor from the actual car body.

(3) The distribution chamber is fixed through fastening means **23** on the wall as well as on the frame or any other suitable place, so that the control means **24** of cock **12** is located near the accelerator, to which it is connected.

The tension rod **25** is adjusted on the dash board and connected by a rope **26** or other means to lever **27** controlling the cock **13**, so that the cocks close the opening **11** when the motor rests. Through joints, and copper piping, the oil vapours feed piping is connected to the distribution chamber at **14** and the moist air feed piping at **15**.

The original carburettor is momentarily removed and the flange **18** is inserted hermetically between the carburettor and the admission collector; then the distribution chamber is connected to the flange by the piping **17**.

The working of the device is the following:

The tension rod is in closed position and the device separated. The motor may consequently be started without any admission of oil vapours or moist air taking place whatever the position of the accelerator may be; but the starting is easier and with greater elasticity since the mixture gasoline-air, which at this time feeds the motor, is being finely pulverized by grates **21**—**21'**.

After the motor has rotated for a few minutes the tension rod **25** may be actuated. The depression in the motor affects the cup **1** and the

atmospheric air sucked in impregnates with water by contacting the strips 5; then it goes through the filtering elements 4, which prevent the water drops from passing through; consequently only moist air arrives at the chamber 16, where it mixes with oil vapours captured in a suitable place of the motor.

This mixture is admitted, in a quantity controlled by cock 12 connected to the accelerator, into the flange 18, where a vigorous turbulence takes place because of motor suction and the passage through the grate 21 of the mixture air-gasoline coming from the carburettor.

The whole forms a homogeneous mixture, which is even more finely pulverized and atomized by grate 21', on the side of the admission collector.

This disposition offers following advantages:

(1) Increased motor efficiency, a remarkably great elasticity and better picking-up conditions with the motor.

(2) Perfectly working lubrification at any time by means of fresh oil, saving lubricant, with less frequent necessity of removing incrustations or scales; consequently longer duration of all members without repairs.

(3) Fuel saving from 25 to 50% according to motor charge and capacity, in consequence of being obliged to reduce the diameter of the main sprayer.

(4) Advanced ignition without crepitation.

It is apparent that shapes, dimensions and disposition of the main organs of this device, as well the materials used in its construction may vary without altering the principle of the invention described.

RAOUL GHEZZI.

PUBLISHED

JUNE 15, 1943.

BY A. P. C.

R. GHEZZI

DEVICES FOR SAVING GASOLINE AND IMPROVING THE CARBURIZATION OF EXPLOSION MOTORS OF ANY KIND, THROUGH THE SIMULTANEOUS ADDITION OF OIL VAPOURS AND MOIST AIR

Filed July 2, 1941

Serial No. 400,874

2 Sheets-Sheet 1

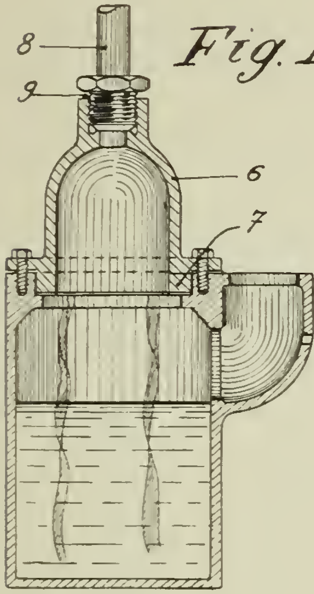


Fig. 1

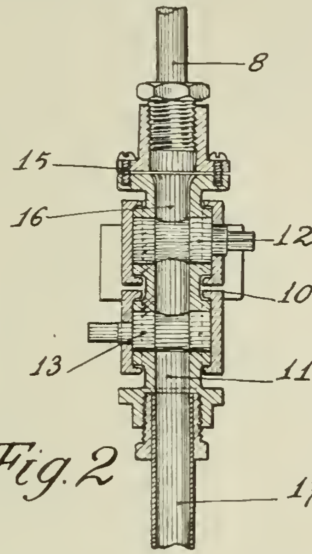


Fig. 2

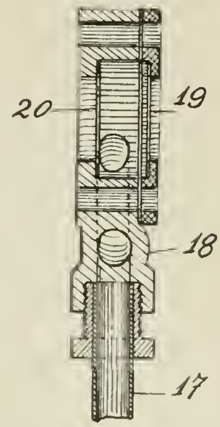
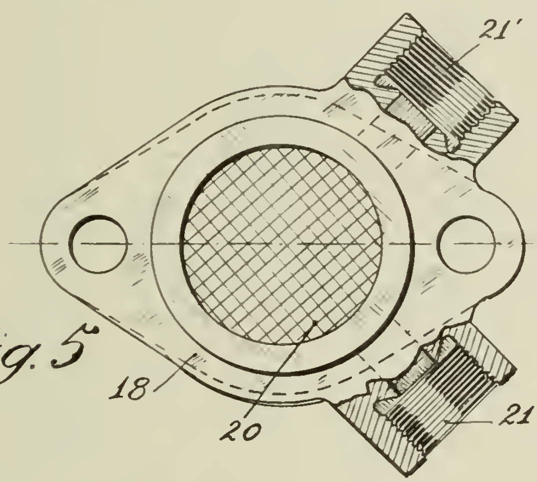


Fig. 3



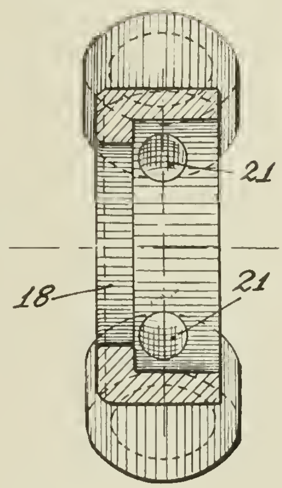


Fig. 5

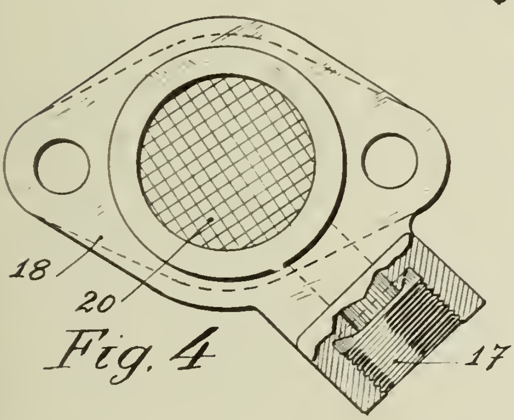


Fig. 4

Raul Ghezzi Inventor

By E. F. Wenderoth

Attorney

PUBLISHED
JUNE 15, 1943.
BY A. P. C.

R. GHEZZI

DEVICES FOR SAVING GASOLINE AND IMPROVING THE CARBURIZATION OF EXPLOSION MOTORS OF ANY KIND, THROUGH THE SIMULTANEOUS ADDITION OF OIL VAPOURS AND MOIST AIR

Filed July 2, 1941

Serial No.
400,874
2 Sheets-Sheet 2

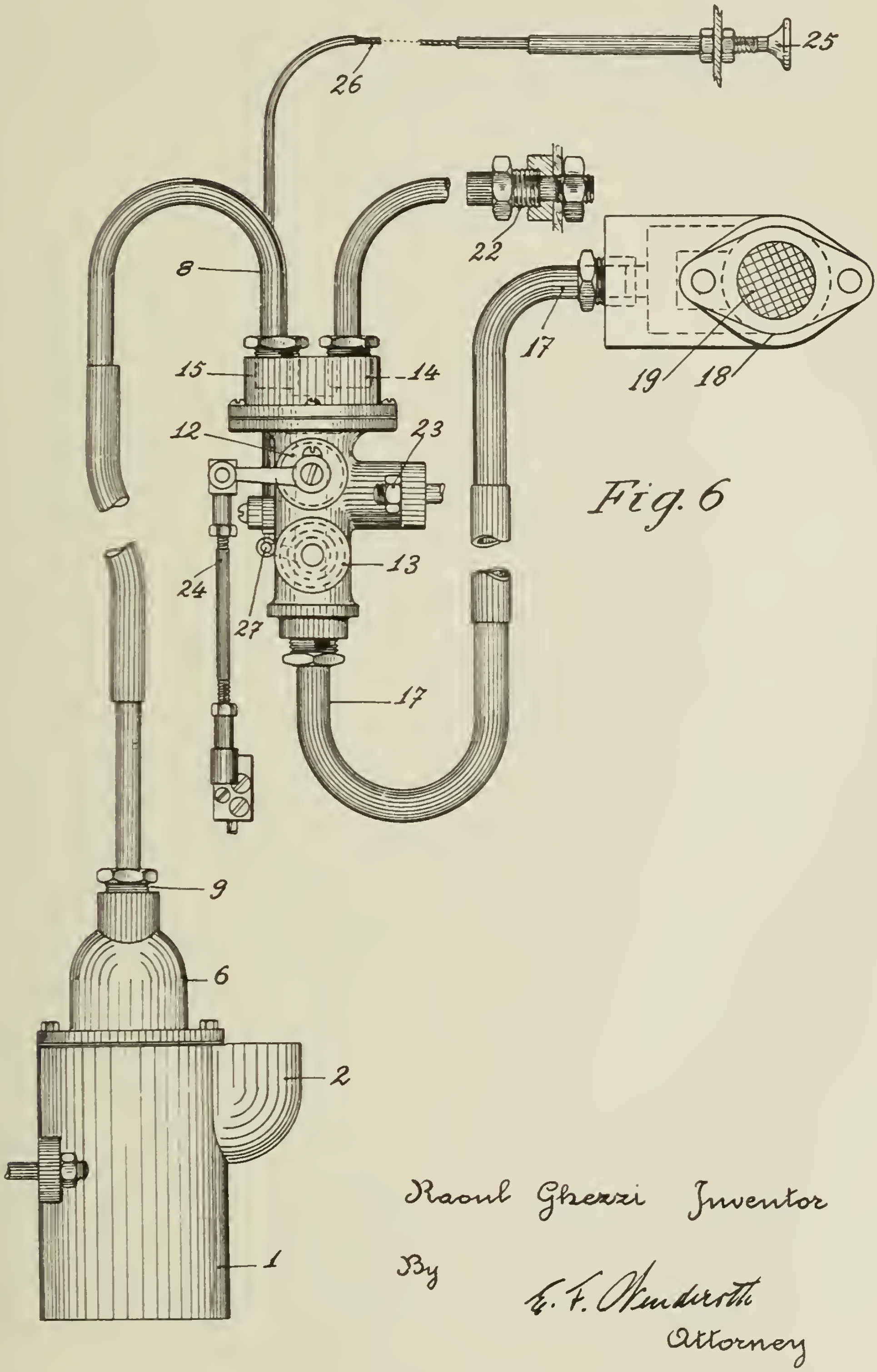


Fig. 6

Raoul Ghezzi Inventor

By E. F. Wenderoth

Attorney

Published June 15, 1943 Serial No. 402,242

ALIEN PROPERTY CUSTODIAN

METHOD OF MANUFACTURING ARTIFICIAL BIOXIDES OF MANGANESE

Alfred Felix Sebastien Bellone, Lyon, France; vested in the Alien Property Custodian

No Drawing. Application filed July 12, 1941

This invention relates to a Method of Manufacturing Artificial Bioxides of Manganese, the principal object of the invention being to provide a method whereby manganese bioxides of high quality may be produced by electrolysis, without having any tendency to adhere to the anodes and in commercially practicable quantities.

Because of the superior chemical and galvanic activity of products obtained by the use of artificial manganese bioxides as compared with the natural manganese bioxides, numerous efforts have been made to produce artificial manganese bioxides. One of the more simple of the methods employed consisted in subjecting a solution of manganese sulfate to electrolysis. However, this method presents so many disadvantages that its industrial application is impractical. By following the modus operandi described by Nichols, "Trans. of the Electro-Chemical Society," vol. LXII,1932, p. 392, that is to say, by the use of a perceptibly neutral medium a bioxide of suitable quality is obtained, but it adheres to the anode so tenaciously that it is extremely difficult to detach it, which characteristic renders the process pretty nearly impracticable. It is possible to avoid this difficulty by maintaining the electrolyte more or less acid. The techniques of this method are described in French Patent No. 323,916 and German Patent No. 163,813. However, in carrying out that method, another serious difficulty presents itself, namely, beside the bioxide there are formed from the manganic sulfate and the bioxide, products of a higher degree of oxidation, and it is well known that the separation of the bioxide from such a mixture involves considerable technical difficulties.

Applicant has found that artificial bioxides of manganese may be obtained without encountering any of the difficulties or inconveniences mentioned above and in sufficient quantity to make it commercially practicable, by subjecting to electrolysis, not a solution of a manganese salt, but a suspension of an insoluble or only slightly soluble manganese compound of a degree of oxidation lower than the bioxide in a solution of an alkaline halide. As examples of insoluble or slightly soluble compounds may be mentioned manganese hydroxide, carbonate, borate, phosphate, silicate. It is to be understood, however, that the invention is by no means limited to these compounds.

In case the insoluble or slightly soluble compound is obtained by precipitating a solution of manganese chloride in a medium of a base or an alkaline salt, the final reaction mixture may be subjected to electrolysis without other treatment. The invention is applicable in particular to products resulting from the treatment by an acid and then by a base, of natural or artificial manganese compounds at least partially soluble in acids, and more particularly to the product obtained by treating by an acid and then by a base, of the sesquioxide of manganese resulting from the roasting reducer of a natural bioxide.

The applicant has further found that it is possible to influence or control the structure of the final product by modifying in the course of the electrolysis, the pH of the medium by addition of basic or acid substances.

The isolation of the reaction product of the medium in which it has been formed presents no difficulty, as it can be accomplished by any of the known means, such as decantation, filtration, etc. The product obtained constitutes a hydrated manganese oxide in which practically all the manganese is in the quadrivelent condition.

Example 1.—50 liters of brine containing in suspension 2 Kg. 500 of carbonate of manganese precipitate are electrolysed for 7 hours, with 200 amperes at about 80–90°. At the end of the time, the bioxide obtained is separated by filtration and is washed and dried. An article made with 5 grs. of this product gives a period of discharge of 6 to 7 hours.

Example 2.—3 Kg. 500 of Mn_2O_3, natural or resulting from reducer roasting of pyrolusite, are treated by suspension in water to which hydrochloric acid has been added to produce weak permanent acidity, then by sodium carbonate for re-precipitating the manganese in solution. On completion of these operations, the electrolysis of this suspension is proceeded with as in Example 1 and a product of analogous properties is obtained.

ALFRED FELIX SEBASTIEN BELLONE.

Published June 15, 1943 Serial No. 402,418

ALIEN PROPERTY CUSTODIAN

PISTON AND PISTON-ROD RINGS

Pierre Anselme Ignace Cuvelier, Cannes, France; vested in the Alien Property Custodian

Application filed July 14, 1941

This invention relates to improvements in piston and piston-rod rings; one object of the invention is to provide in a motor, pump or gas compressor a close fitting joint of the rings with the piston or the piston-rod and the cylinder.

The invention comprises too novel means for oiling in connection with the above and other features an example of which is given in this specification and illustrated in the accompanying drawings in which:

Figure 1 shows a fragmentary ½ symmetrical (to line X—Y) longitudinal view of a piston bearing the rings and of its cylinder;

Figure 2 shows a fragmentary ½ symmetrical (to line X—Y) longitudinal view of a piston and of its cylinder bearing the rings.

Figure 3 is a complete sectional view according the line *a*—*b* of Fig. 2 to show the displacement between themselves of ring cuttings.

In these figures, numeral **1** designates the piston (or a piston-rod in Fig. 2); numeral **2** designates the cylinder; numeral **3** is an annular chamber provided in piston-walls (Fig. 1) or in cylinder walls (Fig. 2) with abutment **4** against which the annular rings **5**, **6**, **7** (fractioned in for instance four equal parts cuttings of which **16** are displaced between themselves so as to close every possible passage to fluid) are pressed as well as against the piston I (Fig. 2) or the cylinder (Fig. 1) by means of a conical ring **9** (fitting to conical margin of ring **7**) itself pushed by coil spring **8** compressed (in Fig. 1) by a threaded annular plate **15** or (Fig. 2) by another set of rings located in a symmetrically (to line C—*d*) opposed cylinder connected to cylinder I through the hole-bored projecting sides **10**.

Spring **8** may also be compressed against an annular plate allowing passage for piston or piston-rod and bolted to the same projecting sides **10**.

One or several parts of the outer all covering ring **9** may be hole-bored in **12** to receive by threading a pipe **13** crossing cylinder walls by hole **14** so as to carry oil under pressure inside the rings if said oil can not be brought in chamber **3** between two symmetrical sets of rings.

PIERRE ANSELME IGNACE CUVELIER.

PUBLISHED

JUNE 15, 1943.

BY A. P. C.

P. A. I. CUVELIER

PISTON AND PISTON-ROD RINGS

Filed July 14, 1941

Serial No.
402,418

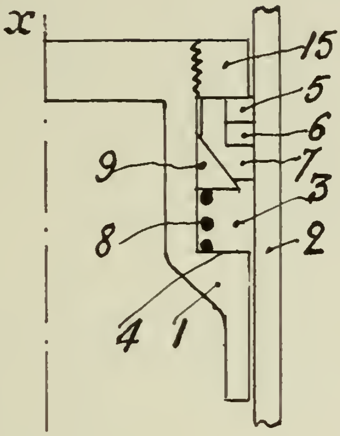
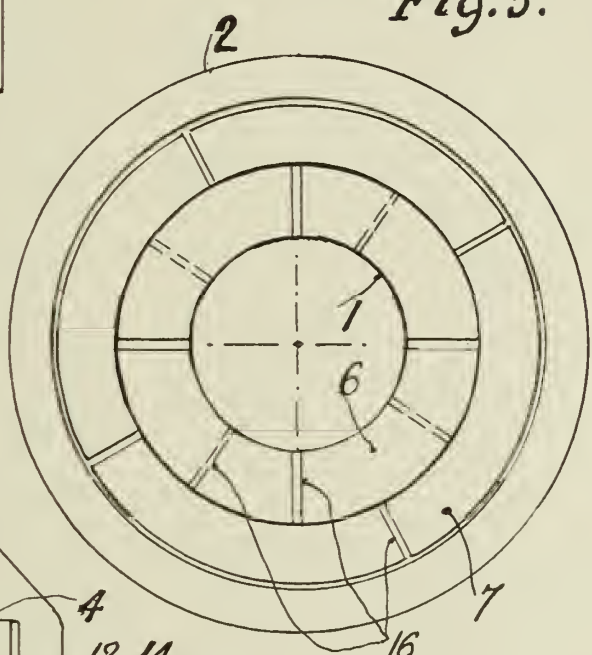


Fig. 1.

Fig. 3.



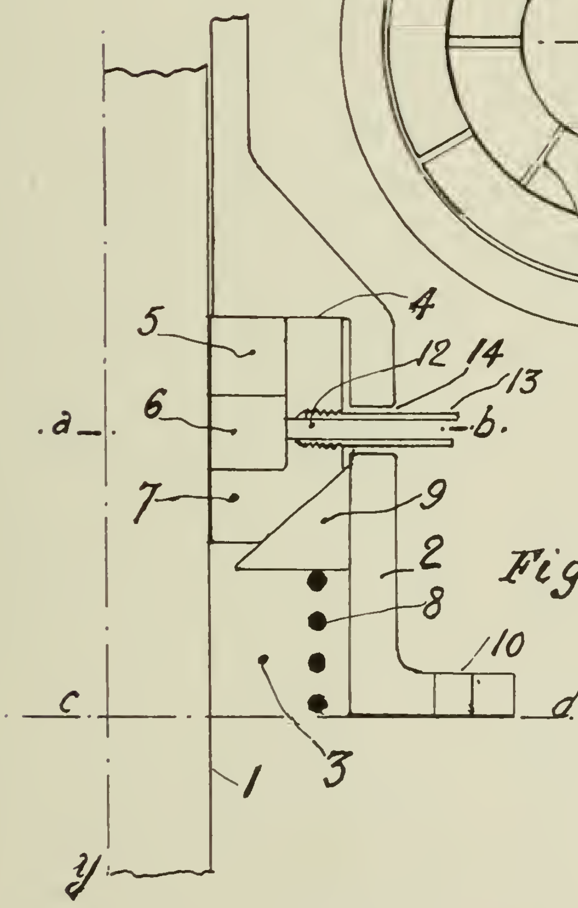


Fig. 2.

PIERRE ANSELME IGNACE CUVELIER

Published June 15, 1943 Serial No. 403,856

ALIEN PROPERTY CUSTODIAN

COUPLING DEVICES FOR THE ASSEMBLY OF TUBULAR ELEMENTS

Edmond Gabriel Laffly, Paris, France; vested in the Alien Property Custodian

Application filed July 24, 1941

The present invention relates to coupling devices for the assembly of tubular elements (such as pipes, tubes, conduits, etc.,) that is to say devices for either coupling these elements with one another or fixing them to parts or structures (such as cocks, tanks, etc.).

This invention is concerned with devices of this kind in which the assembly is obtained by wedging of conical surfaces, or at least having oblique generatrices, carried by the ends or portions to be assembled together.

The chief object of the present invention is to provide coupling devices of this kind which are better adapted to meet the requirements of practise than those used for the same purpose up to the present time and in particular which are more reliable and safer and permit of avoiding uncoupling of the parts.

According to an essential feature of the present invention, in order to transmit the tightening effort, I make use of rings capable, at the end of the tightening operation, or penetrating slightly into the matter of which the parts to be assembled together are made.

According to another feature of the present invention, in order to assemble parts by means of coupling devices made as above explained, I give the conical end of the piece or tube to be assembled an angularity or slope slightly different from that of the piece on which the first mentioned piece is to be fixed, whereby the tightening can take place gradually, advantageously by stretching by means of a ring such as that used according to a first characteristic of the invention as just above set forth.

According to a third feature of the invention, the axial section of the pieces intended to transmit the tightening effort, and in particular of the rings above mentioned, is made of such a shape that their active edge forms an angle at most equal to 90°, and preferably a slightly acute angle.

Other features of the present invention will result from the following detailed description of some specific embodiments thereof.

Preferred embodiments of the present invention will be hereinafter described, with reference to the accompanying drawings, given merely by way of example, and in which:

Fig. 1 is an axial sectional view of two adjacent ends of two pipes, respectively, and of a coupling device for assembling these pipes together, this coupling device being made according to the invention;

Fig. 2 is a part view of the same system, shown on an enlarged scale;

Fig. 3 is a separate view showing certain parts of the system, in the respective positions they occupy with respect to each other at the beginning of the operation of assembly;

Fig. 4 is a part view, in axial section, with a coupling device of the "male nut" type made according to the invention;

Fig. 5 is a detail view showing an element of a coupling device made according to the present invention, this element being different from the corresponding element of the system illustrated by Figs. 1 to 4;

Fig. 6 is a view similar to Fig. 5 and corresponding to a modification.

In the following description, it will be supposed that it is desired to provide a coupling device for the assembly of two elements at least one of which is constituted by a pipe, while the other is constituted, for instance, by the nozzle of a cock or of a container, or by another pipe. The coupling device according to the invention will be made as follows:

The end of the pipe to be assembled is given a conical shape, in the known manner, and this end is fitted on a support which is itself of conical shape, after which the whole is tightened so as to bring the two conical surfaces together and to produce the wedging thereof.

But, for this tightening operation, instead of directly transmitting the tightening efforts to the parts in question, as this was made up to this time, I have recourse, according to one of the features of the invention, to at least one intermediate element advantageously constituted by a ring previously engaged on the corresponding end of the pipe.

According to another feature of my invention which is preferably used in combination with that above mentioned, the end of the pipe is made of a conicity slightly different from that of the element, also of conical shape, on which it is to bear, the two cones fitting in each other only under the effect of the stresses developed during the tightening operation.

It is clear that a coupling device embodying the characteristics above mentioned can be made in many different ways.

For instance, supposing, by way of example, that it is desired to assemble together two pipe ends 1 and 2 (Fig. 1) by wedging thereof on a biconical intermediate support 3, I make use of two male and female nuts 4 and 5. These units are caused to act, at least at the beginning of

the tightening operation, not directly on the conical ends 6 and 7 of said pipes but on rings or groups of rings 8, each of these rings or groups of rings bearing on one side on shoulders provided in said nuts and acting, on the other side on the corresponding conical portion, to wit 6 or 7.

If these conical portions 6 and 7 are made of a conicity β slightly greater than the conicity α of support 3, the whole can be arranged to work in the following manner (which however should be considered as corresponding only to an example):

The parts are made so that, at the beginning of the tightening operation, ring 8 comes at B, slightly beyond the free edge A of piece 3.

From this time on, the tightening effort produces a slight stretching or drawing of the conical end 6 or 7 of the pipe, and also a slight displacement of said pipe with respect to support 3 and a deformation which tends to reduce conicity β so as to adapt it to conicity α.

It should be noted that the effort to be developed on the the nuts for obtaining the desired tightening remains relatively small, due to the fact that said nuts are not still in contact with the pipes but are merely in contact with the rings and can easily slide on the latter.

Finally, as the tightening operation is being completed, the edge 9 of the rings comes to penetrate into the metal of the pipes and becomes fixed thereon, forming ridges 10 which ensure a perfect fluidtightness.

I may further arrange things so that the end bore 11 of each nut comes itself, at the end of the tightening operation, into contact, at least partly, with the pipe. It should be noted that it is advantageous to give this bore a certain conicity, preferably of a value γ smaller than β, for instance averaging α.

All that has been said above applies of course to any other kind of coupling device.

For instance, in Fig. 4, I have shown a coupling device of the male nut type 12, which comes to screw inside a piece 3^1 playing a part analogous to that of the biconical support 3 of the first embodiment.

According to still another feature of the invention, the device is so made that the part adapted to exert the tightening action, has, in axial section an active edge of a form corresponding to an angle of at most 90°; and preferably slightly acute.

When this part is constituted, as above supposed, by a ring, it is sufficient, as shown by Figs. 1 to 4, to make the inner surface of the ring of cylindrical shape and to give it plane faces perpendicular to the axis.

But, it is advantageous, especially in the case of pipes of metals which are relatively hard, to make the angle C corresponding to the active edge 9 (Figs. 5 and 6) an acute angle.

This result is obtained, in the case illustrated by Fig. 5, by providing a recess 13 in the lateral face of the ring adjacent to said edge 9.

In the embodiment of Fig. 6, this acute angle C is obtained by giving the inner bore of the ring a certain conicity in a direction opposed to that of the pipe.

Of course, it should be well understood that, in each case, the matter of which the rings are made is to be chosen in accordance with the nature of the matter of which the tubes or pipes are made. These tubes or pipes may be made of all kinds of metals, such as copper, brass, aluminium, light alloys, steel, etc.

As a rule, the rings are made of a hardness much greater than that of the tubes or pipes. For instance, they will be made of high strength brass, aluminium brass, duralumin, soft steel, semi-soft steel or higher steels.

The rings can be subjected to any suitable surface treatments, for instance in order to avoid galvanic effects with the metal of the tubes, for instance cadmium plating, copper plating anodic oxidizing, and so on.

On the other hand, these rings can be subjected to any suitable thermic treatment (cementation, nitriding, cyaniding, tempering, etc.).

Whatever be the particular embodiment that is chosen, I obtain a coupling device the operation of which results sufficiently clearly from the preceding description for making it unnecessary to enter into further explanations.

The coupling devices according to the invention have, over other coupling devices as made prior to this invention, many advantages among which the following may be cited:

Separation of the elements coupled together is made impossible;

The tightening operations are greatly facilitated;

The coupling device is simple and cheap to manufacture.

Attention is called to the fact that the coupling devices according to the invention are advantageous to use for the assembly of tubular conductors for high voltage currents, these conductors being made of copper or light metals.

Of course, the features above described, and in particular those relating to the relative conicities of the surfaces intended to come into contact with one another can be applied, according to the invention, even in the case of coupling devices unprovided with rings as above mentioned.

EDMOND GABRIEL LAFFLY.

PUBLISHED

JUNE 15, 1943.

BY A. P. C.

E. G. LAFFLY
COUPLING DEVICES FOR THE ASSEMBLY
OF TUBULAR ELEMENTS
Filed July 24, 1941

Serial No.
403,856

Fig. 1.

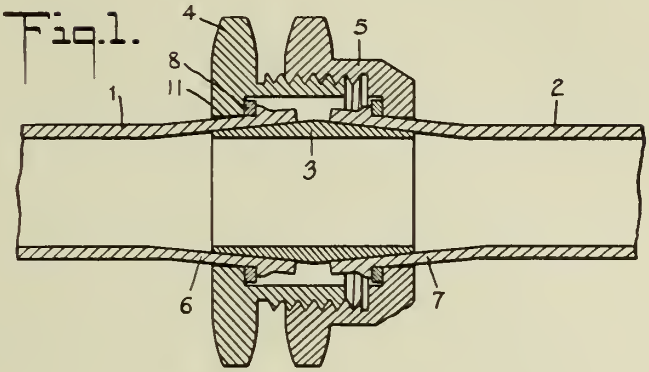


Fig. 2.

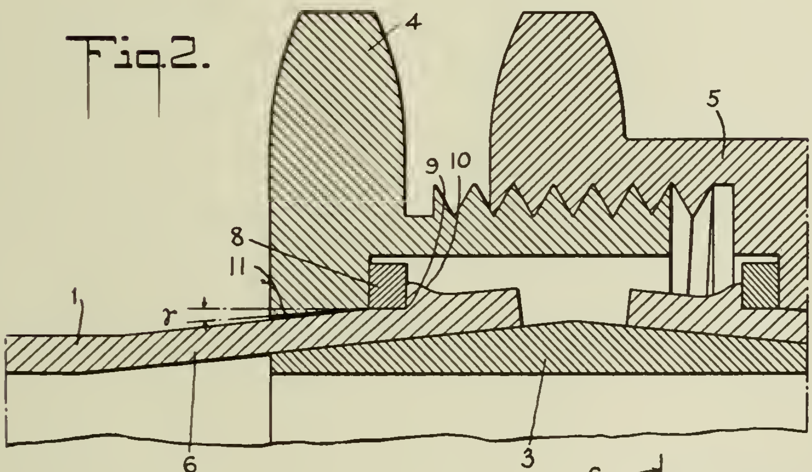


Fig. 3.

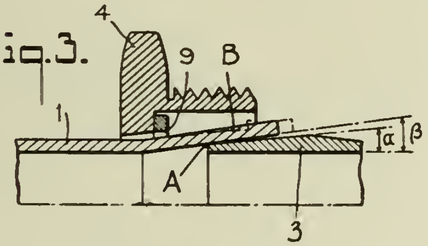


Fig. 6.

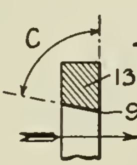


Fig. 4.

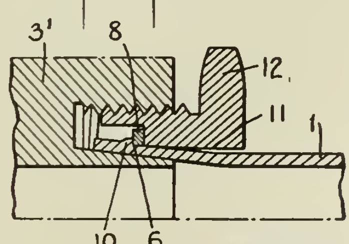
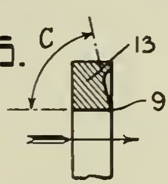


Fig. 5.



INVENTOR
Edmond Gabriel Laffly
BY Henry J. Lucke
HIS ATTORNEY

Published June 8, 1943 Serial No. 413,856

ALIEN PROPERTY CUSTODIAN

FASTENING DEVICES FOR CASEMENT WINDOWS, DOORS AND THE LIKE

Cornelis van der Leun, The Hague, Netherlands; vested in the Alien Property Custodian

Application filed October 6, 1941

This invention relates to fastening devices for casement windows, doors and the like, of the type comprising two substantially aligned espagnolette bolts adapted to be simultaneously shot (and retracted) in opposite directions by means of suitable actuating mechanism.

The main object of the invention is a fastening device of this type, which, owing to the extreme simplicity of its bolt actuating mechanism, is very cheap to manufacture and occupies very little space. With this object in view, the bolts have a U-shaped or similar hollow section, whereas the actuating hand lever is pivoted behind one of the bolts and projects through an aperture thereof so as to be adapted to exert pressure on an edge of said aperture to thereby move the bolt in either direction, the second bolt being coupled, directly or through a connecting rod, to that portion of said lever which extends behind said pivot.

In order that my invention may be fully understood, I shall describe, by way of example, two embodiments thereof with reference to the annexed drawing, in which:

Fig. 1 is a longitudinal sectional elevation of one embodiment of the invention,

Fig. 2 is a cross-sectional view along the line II—II in Fig. 1,

Fig. 3 is a longitudinal sectional elevation of a second embodiment of the invention, and

Fig. 4 is a cross-sectional view along the line IV—IV in Fig. 3.

The fastening device shown in Figs. 1 and 2 comprises two aligned bolts **5** and **6** adapted to be moved towards and from one another by means of an actuating hand lever **7** hinged on a pivot **9**. This pivot is secured to the side walls of a casing **8**, into which the adjacent ends of the bolts project. The front wall of the casing has an elongated aperture **10** for the passage of the lever **7**.

Each bolt consists of a length of U-section, whose web and flanges have a sliding fit with the front wall and with the side walls, respectively, of the casing. The web of bolt **6** is provided with an elongated aperture **11**, through which the lever **7** passes, said aperture being sized as to allow the lever to freely move between its extreme positions. Behind the pivot **9**, the rear portion of the lever, which projects from the casing, is hinged as at **12** to one end of a pair of parallel coupling rods **13**, the other end of which is pivoted, through a pin **14**, to the inner end of bolt **5**.

The post of the window frame or the like, to which the flanges **8***a* of the casing are to be secured, should have a suitable recess to accommodate those portions of the lever **7** and of the coupling rods **13**, which project from the rear of the casing.

In the embodiment shown in Figs. 3 and 4, the inner end of bolt **5** has an offset portion **5***a* extending, in parallel relation with and just in front of the inner portion of bolt **6**, within the correspondingly shaped casing **8**. The web of said offset portion has an aperture **15**, through which and through an opening **10** in the front wall of the casing the actuating lever **7** passes. The pivot **12** of said lever is situated intermediate the offset portion **5***a* and the second bolt **6**. The rearwardly extending end portion of lever **7** projects into the space between two abutment pins **16** and **17** secured to the flanges of bolt **6** so as to directly engage the latter when moving in either direction.

CORNELIS VAN DER LEUN.

PUBLISHED

JUNE 8, 1943.

BY A. P. C.

C. VAN DER LEUN
FASTENING DEVICES FOR CASEMENT
WINDOWS, DOORS AND THE LIKE
Filed Oct. 6, 1941

Serial No.
413,856

FIG.1

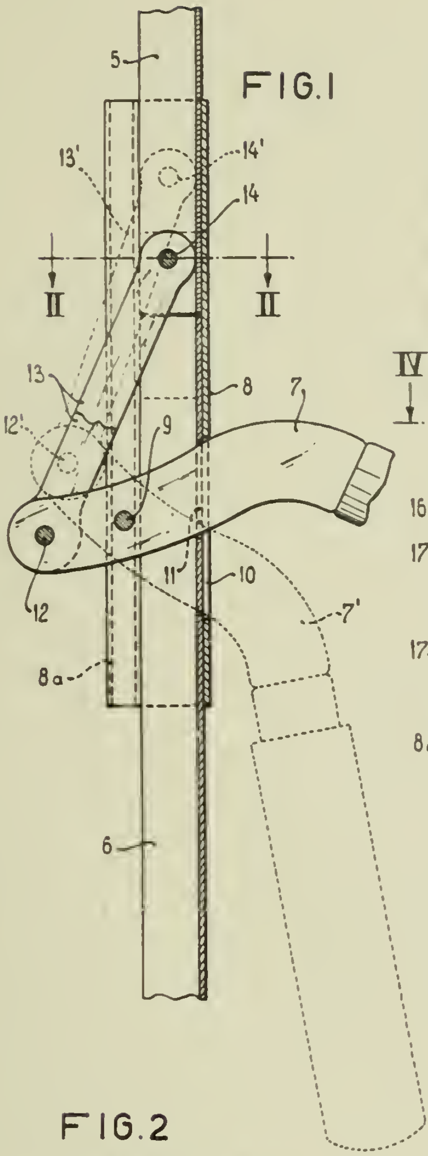


FIG.3

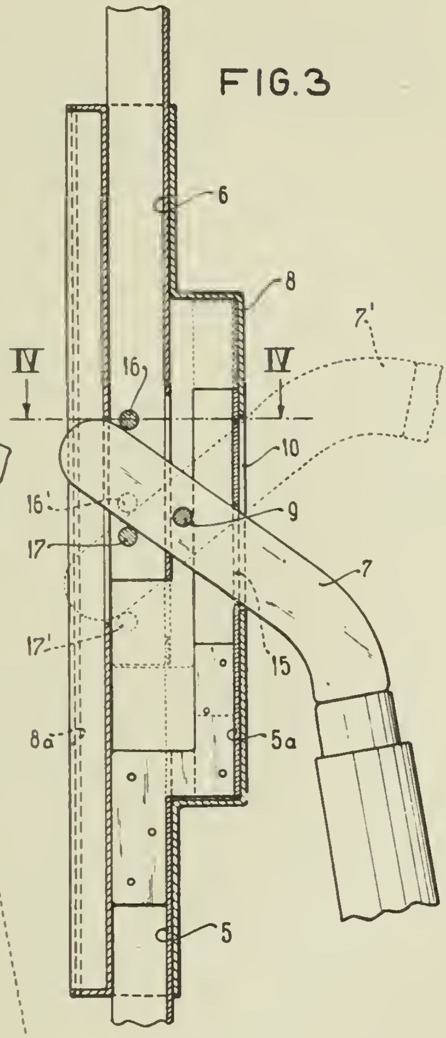


FIG.2

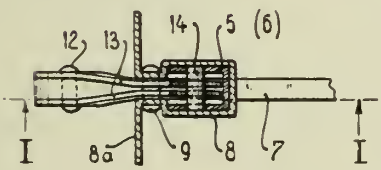
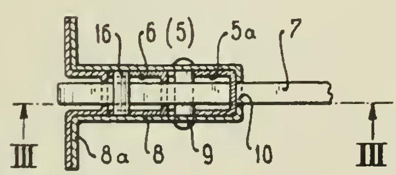


FIG.4



Inventor:
C. van der Leun
By: Stevens & Davis.
Attys.

Published June 15, 1943 Serial No. 414,208

ALIEN PROPERTY CUSTODIAN

METHOD OF APPLYING A LINING TO MACHINE ELEMENTS

Ernst Meier, Senior, Braunschweig, Germany; vested in the Alien Property Custodian

Application filed October 8, 1941

My invention relates to improvements in the method of applying a lining to machine elements such for example as worm gears, gear wheels, shafts, nuts, piston rods, etc., and more particularly to elements which heretofore were made from bronze, brass, and similar materials. The object of the improvements is to provide elements of this class the basic body of which consists of low-carbon iron, forged or rolled steel, steel castings or malleable-iron castings and a lining applied thereto and consisting of lead bronze, brass, bronze, red brass or another copper alloy, the said lining forming the part of the element which is subject to highest strain, such for example as the teeth of the gear wheel, or the material from which the said teeth or the like are to be cut. The said lining may be applied to the basic body by casting or it may first be made as an independent body by casting or by cutting the same from a solid block. After the lining having thus been applied the basic body and the lining are heated in a mould enclosing the same for a length of time of from 60 to 300 minutes at a temperature of from 1000 to 1100° C, whereupon the lining is intimately bound to the basic body.

For the purpose of explaining the invention several elements made by my improved method and apparatus for thus manufacturing the said elements have been illustrated in the accompanying drawing, in which the same letters of reference have been used in all the views to indicate corresponding parts. In said drawing

Fig. 1 is a perspective view showing a toothed segment consisting of a basic body and a lining applied thereto,

Fig. 2 is a similar perspective view showing a shaft having a lining applied to a part of its surface,

Fig. 3 is a top plane view showing the bottom part of a moulding box and a basic body and the mold located therein,

Fig. 4 is a sectional elevation taken on the line **4—4** of Fig. 3,

Fig. 5 is a sectional elevation showing a furnace for heating the said element and the mould, and

Fig. 6 is a perspective view showing means for cooling the element.

In the example shown in Fig. 1, the element such as a toothed segment is composed of a basic body **1** made from iron, steel or another suitable metal, and a lining **2** from which the teeth are formed. Fig. 2 shows another example in which the element is a shaft **3** which has a lining **4** of a copper alloy applied thereto. In both cases the linings **2** and **4** are intimately bound to the basic bodies **1** and **3** respectively by the method described hereinafter.

In Figs. 3 and 4 I have illustrated a method of applying the lining to the basic body **1**, the said lining being applied by casting. The basic body **1** is placed in a moulding box **5** and it is embedded into so much sand **6** or other moulding material that sufficient space is left for casting the lining metal into the same, as has been indicated at **7**. In Fig. 4 the lower and upper molding boxes **5** and **8** are shown assembled. The lining metal is cast into the mould, and after solidification thereof the moulding box **5**, **8** with the lining applied thereto is placed into a heating chamber **9**, and the molding box and element are heated at a temperature sufficient for intimately binding the lining to the basic body. I have found that ordinarily a temperature of from 1000 to 1100° C is sufficient and that the said heat must be applied during a period of time of from 60 to 300 minutes and according to the character of the lining metal and the size of the element.

After the lining has thus been bound to the basic body the element is taken from the molding box and rapidly cooled, for example by spraying water thereon, as is illustrated in Fig. 6 showing a suitable spraying device **10**.

While in describing the invention one specific method has been illustrated, I wish it to be understood that my invention is not limited to the method shown herein, and more particularly to the method of applying the lining to the element.

I have found that a lining thus applied rigidly adheres to the basic body.

ERNST MEIER, Sr.

PUBLISHED

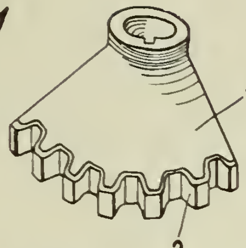
JUNE 15, 1943.

BY A. P. C.

E. MEIER, SR
METHOD OF APPLYING A LINING
TO MACHINE ELEMENTS
Filed Oct. 8, 1941

Serial No.
414,208

Fig. 1



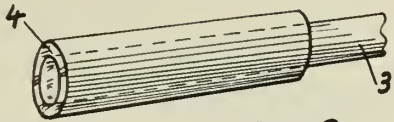


Fig. 2

Fig. 3

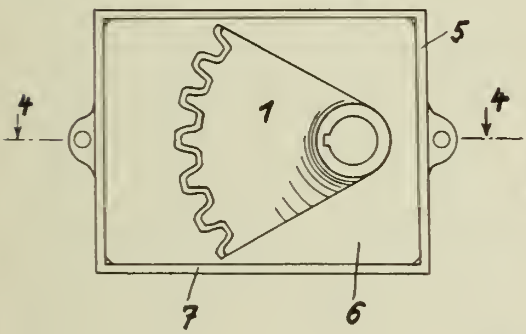


Fig. 4

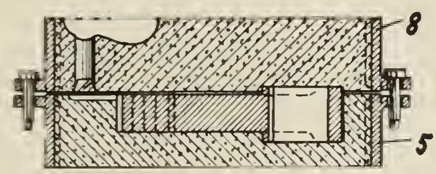


Fig. 5

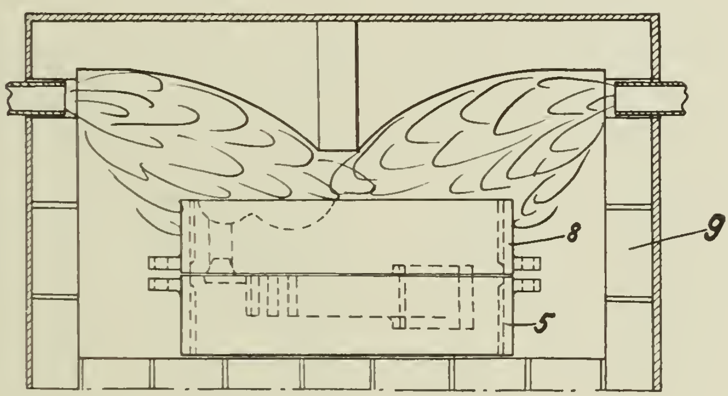
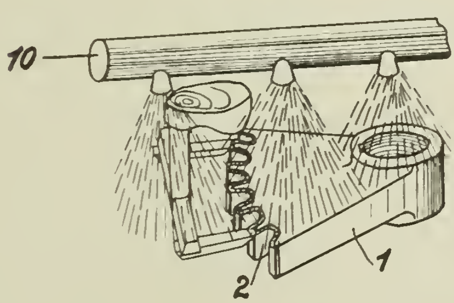


Fig. 6



INVENTOR

Ernst Meier, Sr.

By [illegible]

ATTORNEY

Published June 8, 1943

Serial No. 414,298

ALIEN PROPERTY CUSTODIAN

TELEVISION PICK-UP TUBE

Rudolf Behne and Walter Buhs, Berlin, Germany; vested in the Alien Property Custodian

Application filed October 9, 1941

The invention relates to television transmission tubes and in particular to pick-up tubes of the charge storage type. The charge storage tubes operating with a scanning cathode ray have the drawback that the video signal is distorted by a signal producing an uneven distribution of the brightness over the picture area.

Usually the presence of the distortion signal is explained by the unsymmetrical distribution of the potentials of the charge storage elements in consequence of the unsymmetrical scanning operation. It is also explained by the fact that in many cases the plane of the screen is not vertical to the central position of the scanning ray. It has also been found that the distortion signal is influenced by the unsymmetrical distribution of light in the image so that the distortion signal depends upon the content of the transmitted pictures.

It is an object of the present invention to provide a cathode ray scanning tube which is free from a distortion signal. It is a further object to improve the compensating means which have been hitherto employed in order to suppress the distortion component of the image signals. It is another object to improve the type of tubes in which additional electrodes are arranged in front of the mosaic electrode in order to produce a more uniform field for drawing away the electrons. A further object is to provide a cathode ray scanning tube including a secondary emission multiplier for immediately multiplying the electrons which are liberated from the storage electrodes by the scanning action. A particular object of the invention is to provide a new and improved input system for the secondary emission multiplier arranged in a cathode ray scanning tube.

According to the invention a tube is employed in which the storage electrode is not illuminated directly but in which the charges are produced by electrons emitted by a separately arranged photoelectric cathode. A tube of this type is combined with a secondary emission multiplier. The first stage of the multiplier is formed by a number of electrodes surrounding the path of the photoelectrons completely or at least partly and consisting of surfaces forming in their combination a frame or ring. The individual electrode elements are insulated from one another. This input electrode has at the same time the function of producing a suitable field distribution by applying different potentials to the individual elements of the complete frame electrode. It has the further effect that the electrons emitted by the storage electrode during the scanning action are multiplied to a larger or smaller degree in dependency upon the potential of the individual electrode element. The following electrodes of the multiplier are arranged laterally to the path of the photoelectrons and of the scanning ray preferably in an extension of the tube having a similar situation as the extension containing the electron gun system. The unsymmetrical field distribution produced by this extension can be easily equalized or neutralized by a suitable choice of the potentials of the individual electrode elements.

Experiments have shown that very good results have been obtained by an arrangement of this type. The arrangement has also the advantage that it is simple in construction and that the first secondary emissive electrode can be easily activated and sensitized.

Other aspects of our invention will be apparent or will be specifically pointed out in the description forming a part of this specification, but we do not limit ourselves to the embodiment of the invention herein described, as various forms may be adopted within the scope of the claims.

Referring to the drawing

Fig. 1 shows a longitudinal section through a tube according to the invention and Fig. 2 a cross section through the tube of Fig. 1 in a plane near the storage electrode.

The cathode ray tube 1 contains a photoelectric cathode 2 and a storage electrode 4. The electron image produced by the photoelectric cathode is sharply reproduced by a magnetic lens 3 upon the storage electrode. The storage electrode may for instance consist of an insulating surface. An electron gun system 5 is arranged in a lateral extension of tube 1. A similar extension on the opposite side of the tube contains a system of secondary emissive grids 6 arranged one behind the other. The tube contains wall coatings 7 and 8 forming an electrostatic lens. The tube contains furthermore in accordance with the invention a number of electrodes 9, 10, 11, 12, forming together a ring-like structure. These electrodes are preferably made of the same material and are sensitized in a similar manner as the secondary emissive electrodes of the multiplier 6. The electrode elements 9, 10, 11, 12 have two effects, namely to produce the desired field distribution and to produce a multiplication of electrons liberated at the storage electrode by the scanning action. In this manner it is possible not only to draw away the electrons from the charge storage surface on predetermined paths but it is also possible to in-

fluence the degree of multiplication in accordance with the spot of the screen from which the electrons are coming so that the differences in signal amplitudes can be easily equalized.

The potential applied to electrodes 9, 10, 11 and 12 varies for instance between 0 and 100 V against the potential of the wall coating or anode 8. It is however not necessary in all cases to vary the potential over this entire range. It is furthermore not necessary in all cases to operate with a secondary emission factor higher than 1, but it may be preferable to operate with lower values. It is, however, essential that this factor is changed by adjusting the potential of the electrodes.

The electrode arrangement may also be formed in such a manner that it surrounds the space in front of the storage electrode only partly. One or the other of the electrodes may for instance be omitted.

The drawings show the electrodes in the form of curved metal strips. Other forms of electrodes may be employed instead thereof. The metal strips may be arranged under an angle to the axis of the tube so that they form a part of a cone- or pyramid-like surface opening or widening in the direction to the photoelectric cathode. The angle may be different for different electrodes. The electrodes may also extend further into the direction of the photoelectric cathode or they may consist of narrow strips extending only slightly beyond the surface of the storage electrode.

RUDOLF BEHNE.
WALTER BUHS.

PUBLISHED
JUNE 8, 1943.
BY A. P. C.

R. BEHNE ET AL
TELEVISION PICK-UP TUBE
Filed Oct. 9, 1941

Serial No.
414,298

FIG. 1

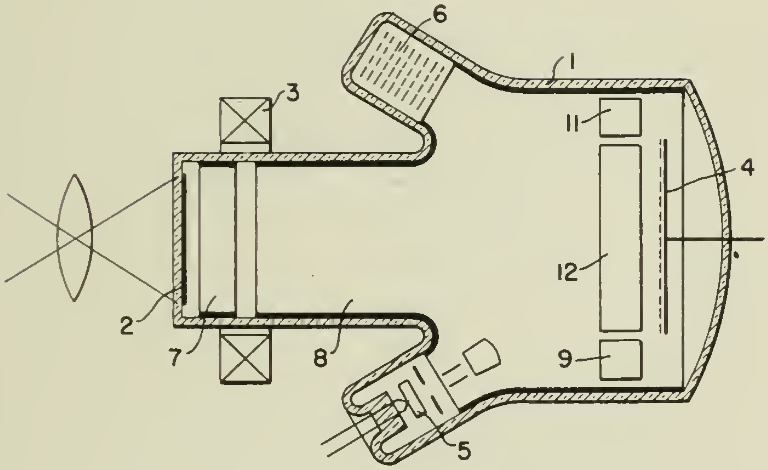
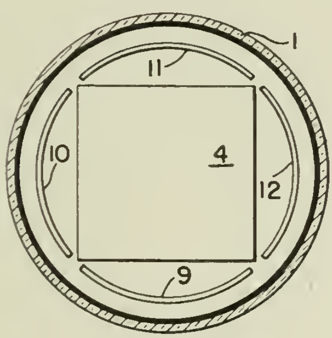


FIG. 2



INVENTORS
RUDOLF BEHNE
WALTER BUHS
BY
ATTORNEY

Published June 15, 1943

Serial No. 416,888

ALIEN PROPERTY CUSTODIAN

GAS REMOVING DEVICE FOR ELECTRIC FURNACES

Léon Michelat, Pamiers, France; vested in the Alien Property Custodian

Application filed October 28, 1941

One of the principal characteristics of electric arc furnaces utilized in the manufacture of steel is to constitute an hermetically closed enclosure. In opposition to the Siemens-Martin type of furnace. where the gases resulting from the reactions during the processing of the metal go off through chimney-stacks. these gases have no other issue in the electric arc furnace than the charging doors and the openings in the roof for the electrodes.

Now. in electric arc furnaces. as perfect gas-tight conditions as possible are sought after, and to this end, it is advisable to obturate the openings for the electrodes by means of flame screens and to render the charging doors as hermetic as possible. It consequently seemed contrary to the principles laid down by electric furnace technicists to provide a chimney stack for the leading out of the gases which are given off in this type of furnaces, the evacuation of the said gases then taking place more or less well through the fissures in the various joints.

These conditions special to the electric arc furnace offer a serious disadvantage when the processing results in the giving off of a large quantity of gases, especially when molten cast iron is to be charged. The quantity of gases given off is then so important that personnel employed is not allowed to approach the furnace.

Moreover, the applicant has noted that even when the charge is entirely solid. it is profitable, at certain times during the processing. to facilitate the leading out of the gases and fumes.

Finally. the applicant has also found that a clarification of the atmosphere about the furnace and inside of it, allows a more constant and active supervision of the roof.

The improvement to electric furnaces which constitutes the object of my invention consists therefore in boring a hole in the top of the roof and in setting over the said hole a chimney-stack preferably bent in such a direction with respect to the electrodes that the fumes may be led away from the space occupied by the said electrodes, which stack is provided with a clack valve or obturator that may be opened when it is desired to let off the gases and fumes.

It is important that this stack does not prevent the movements of the roof caused by its thermic dilatation or contraction. To this effect. the stack is rigidly fixed only to the roof, and to balance the weight of the bent portion. the latter may be connected to a suitable counterweight by means of a cable attached at one end to the frame-work.

The diameter of the stack hole in the roof must be large enough to allow an easy evacuation of the fumes and gases when the obturator is open and sufficiently small to ensure that, during this period of evacuation, there subsists at the bottom of the charging doors, a slight excess pressure preventing the entrance of air.

For example, a diameter of about 250 mm. is suitable for a furnace capable of melting 17 tons of solid charges.

The following description, in connection with the appending drawings, given by way of example not inclusive of all cases will allow a thorough understanding of how my invention can be embodied.

Figure 1 is a vertical sectional view, in diagrammatic form, of an electric furnace provided with the evacuation device.

Figure 2 is a plan view, in diagram form, of this furnace and of the position of the stack with respect to the electrodes. On this figure, I—I shows where the sectional view represented in Figure 1 has been taken.

Figure 3 represents on a larger scale and as a partial vertical section taken at III—III in Figure 2 the device for the evacuation of the gases.

The device shown for the evacuation of the gases is constituted by a stack 1 placed at the key-stone of the furnace 2, above an orifice 11 especially bored to this effect in the roof. In the example shown on the drawings, this stack is bent in a direction opposite to the median electrode 8, as is indicated on Figure 2, so as to prevent the fumes from locking the electrodes 8, 9, 10 and their supports which they would corrode.

The chimney-stack 1, the inside of which is lined with refractory pise, rests on the roof of the furnace by means of an intermediate hollow ring or collar, water-filled, the object of which is to cool the base of the stack that is to say the portion of the said stack which is exposed to the highest temperature and where the risk of deterioration is the greatest. The stack is normally closed by a clack-valve 4 which may be opened at the proper time by operating a cable 12 or by any other means.

The cantilever end of the stack 1 is connected, by means of a balancing device ensuring equilibrum, to the fixed supports 7 of the economizers *8a*, *9a*, *10a* of the electrodes, the said supports resting on small beams *7a* which form the peripheral frame-work of the roof. A guide shoe 15, acting as an integral part of the stack can slide vertically in a guide *15a* fixed to the support 7; a cable 14 fixed by one of its extrem-

ities to the guide shoe 15 and passing over a sheave 13 mounted on the guide shoe 15*a* carries at its other end a counterweight 5 balancing the weight of the bent portion of the stack. The said bent portion is thus upheld by the action of the counterweight 5 without the free movement of the stack and of the roof which carries it being in any way impeded by this arrangement.

In a further effort to allow free vertical movements of translation of the stack in the course of the dilatations and contractions of the roof 2, the base 3 of the stack slides freely in a fixed sleeve 6 acting as an integral part of the support 7.

The device for the leading out of the gases thus constituted offers the following advantages:

1. It allows the efficient evacuation of the gases through the key-stone, at the proper time, without affecting the stability and the life of the roof.

2. It produces, in the furnace, favorable conditions for the supervision of the roof, thanks to the evacuation of the gases and the fumes which clouded the atmosphere of the furnace, prevented a clear vision of the roof by the charging doors 16 of the furnace and proved harmful to the preservation of the roof.

3. It does not hinder the free dilatation of the roof and does not affect the insulation between the electrodes.

It is obvious, that without thereby departing from the scope of my invention, it is possible to modify the embodiment which has been described, especially as concerns the shape of the stack and the manner in which it is mounted.

LÉON MICHELAT.

PUBLISHED | L. MICHELAT | Serial No.
JUNE 15, 1943. | GAS REMOVING DEVICE FOR ELECTRIC FURNACES | 416,888
BY A. P. C. | Filed Oct. 28, 1941 | 2 Sheets-Sheet 1

Fig: 1

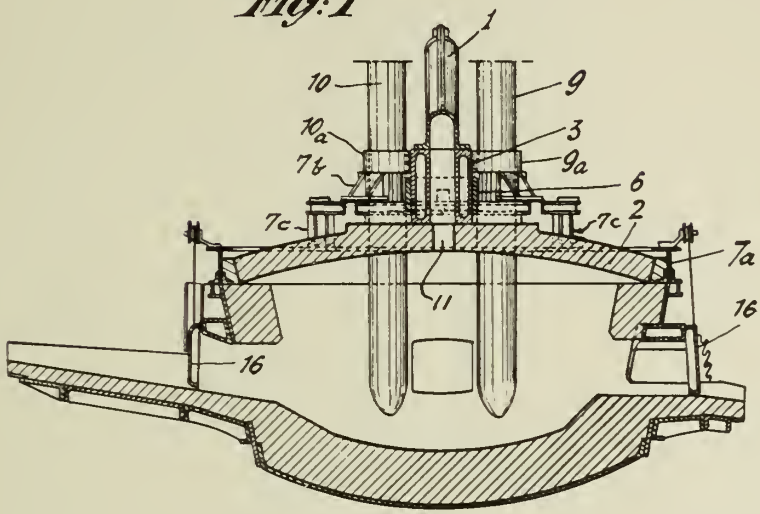
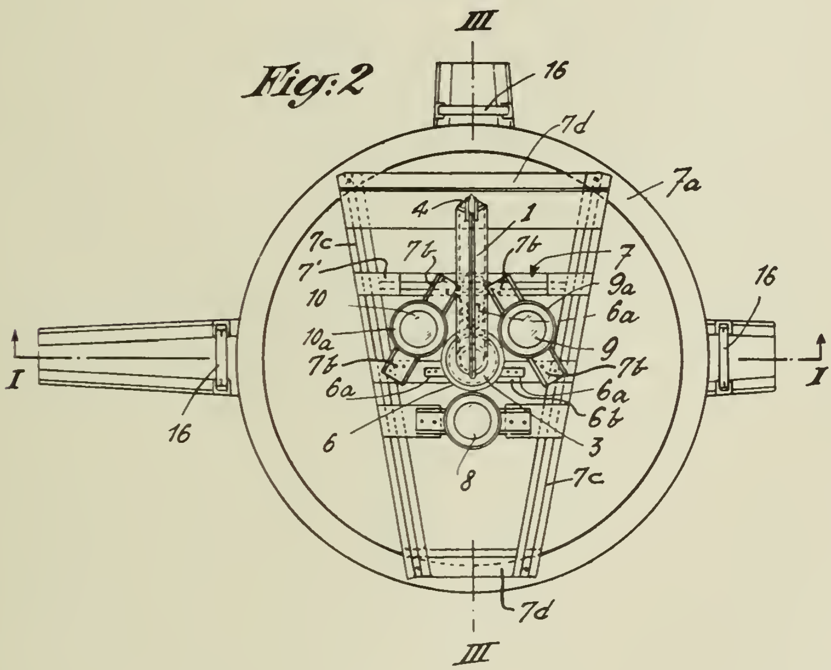


Fig: 2



Leon Michelat

By

Watson, Cole, Grindle & Watson
Attys.

PUBLISHED JUNE 15, 1943. BY A. P. C.

L. MICHELAT

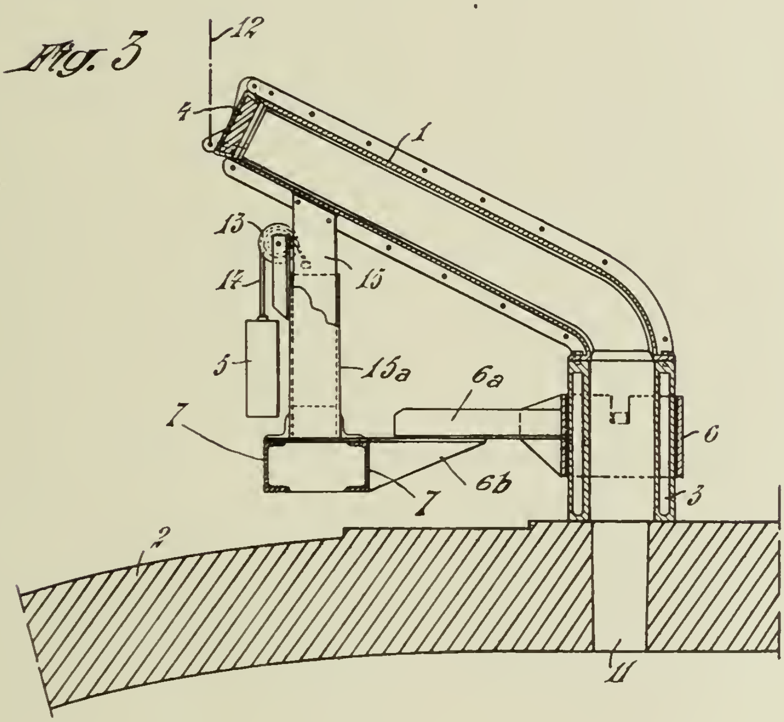
GAS REMOVING DEVICE FOR ELECTRIC FURNACES

Filed Oct. 28, 1941

Serial No. 416,888

2 Sheets-Sheet 2

Fig. 3



Leon Michelat

By

Watson, Cole, Grindle & Watson

Attys

Published June 15, 1943 Serial No. 418,666

ALIEN PROPERTY CUSTODIAN

STARTER FOR FREE PISTON MOTOR COMPRESSORS

Paul Müllejans, Lindau, and Franz Neugebauer, Munich-Allach, Germany; vested in the Alien Property Custodian

Application filed November 12, 1941

This invention relates to a device for starting free piston motor compressors by means of a fluid under pressure.

It is well known in the art to start free piston motor compressors the motor cylinder charge of which is subjected to compression before its combustion in the following manner: The flying mass is fixed in the starting position by a locking device and a starting space in which a piston forming part of the flying mass operates is filled with the starting fluid under pressure. Hereupon the locking device is released. Now the fluid under pressure is capable of displacing the flying mass whereby it expands doing work thus effecting immediately or after reversal of the direction of motion the compression of the cylinder charge.

Furthermore it is well known in free piston motor compressors with multistage compression to utilize all or single working spaces of the stages of compression as starting spaces.

The height of the pressure of the starting fluid, existing in the starting space immediately before setting the flying mass going, is limited in upward and downward direction.

The lower limit is determined by the fact that the motor cylinder charge is to be subjected to the compression required for regular ignition, i. e. for initiating the first motor-working stroke (which is especially important when the motor part as in the usual case works according to the Diesel process). The lower limit of pressure is further determined by the fact that the spaces used for starting must be able to intercept the energy produced in the first working stroke of the motor part by a sufficiently strong cushion of compressed fluid. This is especially important when not the compressor spaces but separate spaces are used for starting, especially in the case of multistage compressors, because then the outlet pressure corresponding to normal operation in these compression spaces is only gradually established in the course of a plurality of strokes.

The upper limit of pressure is of course determined, on the one hand, by the strength of the walls confining these spaces (for instance, in case that a compressor space working with low outlet pressure in the normal operation is used, this pressure cannot be chosen higher or essentially higher than this outlet pressure). On the other hand this upper limit is also determined by the fact that the compression of the motor cylinder charge must not exceed a certain value, as otherwise the pressures of combustion would become so high that the motor part could be damaged.

The importance to be imputed to the right adjustment of the pressure of the starting fluid in the starting spaces, as regards safe starting as well as avoiding detrimental disturbances, makes it desirable to provide efficient safety guards for maintaining the right pressure in the starting spaces.

Therefore an object of this invention is to provide means for automatically maintaining the right starting pressure so that the pressure of the fluid existing in the starting spaces immediately before setting in motion the flying mass does not surpass a predetermined upper or lower limit. These limits are generally remote from each other, but may also coincide.

As means for preventing the transgression of the upper limit of pressure are considered:

(1) A pressure controlling device (pressure reducing valve) inserted into the line for admitting fluid under pressure to the starting space which throttles an optional pressure, for instance, in a container of compressed fluid automatically down to a pressure corresponding to the upper limit of pressure in the starting space;

(2) An overflow valve inserted into the line connecting the starting space with a space of lower pressure and opening as soon as a predetermined pressure in the starting space is attained, thereby allowing fluid under pressure to enter the space of lower pressure;

(3) A safety valve inserted into an outlet of the starting space or behind the overflow valve and opening a passage to the open air as soon as a predetermined pressure in the starting space, or in the space behind the overflow valve respectively, is attained.

Means for preventing the transgression of the lower limit of pressure are:

(*a*) A releasing member charged with the pressure of the fluid under pressure coming from the starting space and releasing a locking member retaining the flying mass only after this pressure has attained a predetermined minimum value (the effective pressure of the releasing member). Therefore the pressure of the fluid in the starting space must be at least equal to the pressure required for releasing the locking member.

(*b*) An overflow valve in the line between the starting space and a space of lower pressure, for instance, the working space of a releasing member, the effective pressure of which is lower than the opening-pressure of the overflow valve. This valve prevents the fluid under pressure from flowing off to a space of lower pressure or to the releasing member, before the starting space is filled with the fluid under pressure up to the lower limit of pressure.

By the indicated means even a double safety guard may be obtained against an excessively high or low starting pressure. With such double safety guard a disturbance can only occur when both safety members fail to operate at the same time. This probability is only a small fraction of the

probability of a disturbance in case of a simple safety guard. This is especially true when both safety members are of different kind, as safety members of equal kind may in certain cases be liable to the same defect and therefore may fail together more easily than two members of different kind.

As a double safety guard against excessive pressure may be provided a pressure-reducing valve in the supply pipe and an overflow valve in an outlet of the starting space, if desired in combination with a safety valve.

A double safety guard against too low pressure is formed by a releasing member connected over an overflow valve with the starting space, the effective pressure of said member approximating the opening pressure of the overflow valve.

The invention proves very valuable also in case that a plurality of starting spaces is provided in an engine which are to be filled with starting fluids of different pressure. In this case the starting spaces are connected with one another or the last starting space (containing the gas of the lowest pressure) with the releasing member by pipes having overflow valves inserted therein. Each of these overflow valves is adjusted to the lower limit of pressure of the starting space placed before it. On opening the compressed gas supply pipe connected with the starting space having the highest pressure the single starting spaces then automatically fill with fluid under pressure up to the lower limit of pressure adjoined to each of the starting spaces and determined by its overflow valve.

Also in this case a double safety guard against excessive pressure is possible for each starting space by inserting, into the pipe between the overflow valve of the one starting space to the next one, a pressure controlling device adjusted to the highest starting pressure admissible for the subsequent starting space.

The invention is illustrated in the annexed drawings, of which

Fig. 1 is a vertical axial cross-section of a starter constructed in accordance with the invention comprising two working spaces, a pressure reducing valve, an overflow valve, a safety valve and a locking and releasing device;

Fig. 2 is a similar cross-section of a starter in which the engine is formed as a multistage compressor;

Fig. 3 is a similar cross-section of an engine having a double safety guard against the formation of an excessive pressure in the low-pressure starting space and

Fig. 4 illustrates a simplification in case the lower limit of pressure in the starting space having the lowest pressure is equal to zero.

The drawings show diagrammatically several modifications of the invention, viz. in each case the left half of a free piston motor compressor provided with oppositely moving flying masses. Corresponding parts of the figures are denoted by the same reference letters.

In the arrangement shown in Fig. 1 a compression cylinder 2 is connected on the one hand with a motor cylinder 1 and on the other hand with a cylinder 3. The flying mass is composed of the motor piston 4, the compression piston 5 and a piston 6 operating in the cylinder 3. The compression cylinder 2 comprises two working spaces: the compression space proper 8 and the working space 9 turned toward the motor cylinder and working as a scavenging pump. The scavenging air flows from the space 9 to a container 10 and from here through the scavenging slots 11 into the motor working space. The working space 12 confined by the cylinder 3 and the piston 6 may be merely used for starting and is after starting connected with the open air through the pipe 13 by opening a shut-off member 14 provided in pipe 13, so that this part of the engine then runs idly. However the space 12 may also operate in the normal working of the engine, for instance, as a cushion or as a higher stage of compression. The compressed fluid for starting is stored under high pressure in a container 20 which may be refilled through a pipe 21 coming from a source of compressed fluid, for instance, a compressor and including a shut-off member 22. A second shut-off member 23 connects the container 20 with a withdrawal line 24 leading to a reducing valve 25 which throttles the pressure of the container down to the maximum pressure admissible in the starting space 12. From the reducing valve 25 a pipe 26 including a hand-operated starting valve 27 leads to the starting space 12. A pipe 28 branching off behind the hand-operated starting valve 27 leads to a similar starting space of the other half of the engine.

A rod 30 is firmly secured to the compression piston and conducted outwards which rod may simultaneously form part of the connecting gear compelling the oppositely moving flying masses to synchronous motion. A tooth or catch 31 is fixed on the rod 30 which may engage a pawl 33 swingable about a stationary fulcrum 32. This pawl is connected with a piston 41 sliding in a stationary cylinder 40. Fluid under pressure may be supplied through the pipe 36 to the space 42 above the piston 41. A pressure spring 43 acts upon the back side of the piston. An auxiliary pawl 38 is further connected with the pawl 33 arranged to engage a stationary abutment 39 when pawl 33 is released from the tooth 31 against the action of the spring 43, whereby pawl 33 is prevented from catching again after being released. By means of a handle 44 provided on the auxiliary pawl 38 the latter may be released from the abutment 39 to initiate a new starting operation. From the starting space 12 a duct 34 leads to an overflow valve 45 connected with the pipe 36 from which a duct 37 is branched off which leads to the open air over a safety valve 46.

In order to make the operation of the contrivance as clear as possible, the following numerical values may be assumed for the single pressures:

	Superatmospheric pressure
Highest admissible pressure in starting space 12	25
Lowest admissible pressure in starting space 12	20
Correspondingly—	
The reducing valve is adjusted to	25
The overflow valve is adjusted to	20
Furthermore—	
The safety valve 46 may be adjusted to	5
The releasing member 41 may be adjusted to	2

The resulting operation is as follows:

The flying mass 4, 5, 6 is at first shifted to the left until the pawl 33 under the action of the spring 43 can engage the catch 31. The shut-off member 14 controlling the starting space 12 is closed and the shut-off valve on the container of compressed fluid 20 is opened. Now the hand-operated starting valve 27 is opened for a

short time and thereby the starting space 12 is filled with fluid under pressure. As soon as the pressure in the space 12 has reached 12 atm. (superatmospheric pressure, hereafter abbreviated as s. p.), the overflow valve 45 opens so that now fluid under pressure may enter the working space 42 of the releasing device 41. When the pressure in the space 42 has reached 2 atm. s. p., the piston 41 overcomes the action of the spring 43 and draws the pawl 33 away from the catch 31. The pressure now existing in the starting space 12 is able to displace the flying mass 4, 5, 6. The starting operation is thereby initiated. The pressure in the starting space 12 cannot surpass in this case the pressure of 20 atm. s. p. to which the overflow valve 45 is adjusted because this valve opens as soon as this pressure is reached, and the excess of fluid will flow off to the releasing device or through the safety valve 46. Should this valve fail to open, the pressure in space 12 would increase at most to the pressure of 25 atm. s. p. established by the reduction valve 25. This involves a double safety device against the formation of an excessive pressure in the starting space 12. A safety guard preventing the pressure in the space 12 from becoming too low is warranted by the fact that the releasing device 41 acts only when it is charged with a pressure of 2 atm. s. p. required for overcoming the pressure of the spring 43. This pressure, however, can only take place when the overflow valve 45 opens, that is when the starting space 12 is filled with fluid under pressure up to the lower limit of pressure (20 atm. s. p.). Should the device 41 fail to release (for instance, by getting jammed or for another reason), the fluid under pressure flowing off over the overflow valve 45 may escape into the open air through the safety valve 46, as soon as the pressure behind the overflow valve 45 has increased to 5 atm. s. p. This means that also in this case an effective safeguard against the formation of an excessive pressure in the releasing space 42 is established.

Fig. 2 shows a modification in which the compressor part of the engine is formed as a multistage compressor so that the cylinder 2 and the piston 5 with the working space 8 form the first stage of compression, and the cylinder 3 and the piston 6 with the working space 12 form the second stage of compression. In this case the working spaces 8 and 12 are to be used as starting spaces at the inner dead center position of the compressor pistons, the pressure of starting fluid to be admitted to these spaces corresponding to the outlet pressures of the stages of compression obtained in the normal operation. Therefore the space 8 is to be charged with compressed starting gas of an essentially lower pressure than the space 12. The pressure valves 51 and 52 are so arranged that the ducts leading from the compression working space to these ducts are closed by the pistons 5 or 6 respectively in the starting position of said pistons, as shown in Fig. 2. In order to prevent the compressed starting gas from flowing off at the subsequent starting stroke from the working spaces through these pressure valves into the discharge pipes yet free from pressure on starting, a so-called pressure maintaining valve 53 or 54 respectively is arranged behind the pressure valves of each compression stage. Each pressure maintaining valve comprises a valve disk 57 opening toward the discharge pipe 55 or 56 respectively and a piston 58 which is charged on the valve side with the pressure of the discharge pipe and on the other side by a spring 59. The action of the spring is a little superior to the pressure of the starting gas acting on the valve disk. Consequently the pressure-maintaining valve remains closed on starting; but in the normal operation during which the full final pressure of the corresponding compression stage permanently prevails this valve is continuously kept open by this pressure.

The means for supplying fluid under pressure to the space 12 are similar to those shown in Fig. 1. The space 12 is again connected to the duct 34 leading to the overflow valve 45. From the latter a pipe 60 leads to the working space 8. This space is connected by a duct 62 to an overflow valve 47, from which a pipe 36 leads to the releasing space 42. Furthermore a pipe 37 is branched off from pipe 36 leading to the safety valve 46 which opens into the open air.

For the pressures the following numerical values may be assumed:

	Atm. s p.
Highest admissible pressure in the starting space 12	25
Lowest admissible pressure in the starting space 12	20
Highest admissible pressure in the starting space 8	6
Lowest admissible pressure in the starting space 8	4
Correspondingly—	
The reduction valve 25 is adjusted to	25
The overflow valve 45 is adjusted to	20
The overflow valve 47 is adjusted to	4
Furthermore—	
The safety valve 46 may be adjusted to	2
The releasing member 41 may be adjusted to	1

When the pressure in the high-pressure starting space 12 on supplying the fluid under pressure has attained 20 atm. s. p., the overflow valve 45 opens and allows the fluid under pressure to pass to the low-pressure starting space 8. When therein the pressure has attained 4 atm. s. p., the overflow valve 47 opens and allows the fluid under pressure to flow through the pipe 36 to space 42 of the releasing device 41. This device releases the pawl 33 as soon as the pressure in pipe 36 has attained 1 atm. s. p. At this moment the high-pressure starting space 12 is filled with compressed fluid under a pressure of 20 atm. s. p., the low-pressure starting space 8 with compressed liquid under a pressure of 4 atm. s. p. This filling of the two starting spaces with compressed liquid under the pressure intended for them respectively automatically takes place on opening the hand-operated starting valve 27. Depending upon the pressure-reducing valve 25, the maximum pressure in the starting space 12 cannot exceed the value of 26 atm. s. p. in case the overflow valve 45 should fail to open. Likewise the pressure in the low-pressure starting space 8 cannot assume an excessive value should the releasing device 41 fail to operate, because it is allowed to drop owing to the overflow valve 47 and the safety valve 46; moreover the upper limit of the pressure in the releasing space 42 is also determined by the safety valve 46.

If it is desired to doubly safeguard the low-pressure starting space against excessive pressure, the arrangement shown in Fig. 3 may be adopted. Again the overflow valve 45 is connected to the outlet 34 of the high-pressure start-

ing space 12. Into the pipe 60 coming therefrom a pressure-controlling device 65 is inserted which is adjusted in such a manner that in its outlet 61 connected with the low-pressure starting space 8 only the highest pressure admissible in this space can occur. Further a safety valve 66 communicating with the open air is connected to a pipe 63 branched off from pipe 60. At the point where the pipe 61 communicates with the space 8, advantageously a check-valve 64 may be provided in order to keep away the variations in pressure occurring in space 8 during the normal operation from the pressure-controlling device 65. The numerical example given in connection with Fig. 2 is therefore to be completed as follows:

	Atm. s p.
The pressure-controlling device 65 between the two starting spaces is adjusted to	6
The safety valve 66 before the device 65 may be adjusted to	18

In space 8 also on failing of overflow valve 47 to open no pressure exceeding 6 atm. s. p. can occur. Should the pressure-controlling device 65 fail to open the fluid under pressure would escape into the open air from the space 12 over the valves 45 and 66.

If as in the examples according to Figs. 2 and 3 different working spaces are used for starting filled with fluid under different pressures, a simplification is possible in some cases, viz. if the lower limit of pressure in the starting space having the lowest pressure is equal to zero, i. e. if the engine scarcely starts at a pressure of 0 atm. s. p. existing in this starting space, but it is desired that this working space also participates in the starting operation.

In this case the arrangement shown in Fig. 4 may be adopted which differs from that shown in Fig. 2 by the space 8 working with the lower starting pressure being immediately connected with the releasing space 42 over the pipe 36, without the intermediary of an overflow valve. To this pipe 36 merely the safety valve 46 leading to the open air is connected over the branch pipe 37.

For this example the following numerical values may be assumed:

	Atm. s p.
The highest admissible pressure in the high-pressure starting space 12 may be	25
The lowest admissible pressure in the high-pressure starting space 12 may be	20
The highest admissible pressure in the low-pressure starting space 8 may be	6
The lowest admissible pressure in the low-pressure starting space 8 may be	0

Correspondingly—

The pressure reducing valve 25 is adjusted to	25
The overflow valve 45 is adjusted to	20
The safety valve 46 behind the low-pressure starting space is adjusted to	6
Further the releasing member 41 may be adjusted to	4

In this case the operation of the device is as follows:

In the normal case the pawl 33 is released when the pressure influencing the releasing member 41 has attained the value of 4 atm. s. p. The same pressure then acts in the low-pressure starting space 8, whereas in the high-pressure starting space 12 a pressure of 20 atm. s. p. is acting. Should is now occur that due to a defect of the releasing member as, for instance, relaxation in force of the spring 43, the releasing of the catch 33 takes place already at a pressure essentially lower than the pressure of 4 atm. s. p. provided for this releasing operation, for instance, at ½ atm. s. p., it is true that likewise only a pressure of ½ atm. s. p. assists in starting, but the engine is nevertheless set in motion, because the starting pressure of 20 atm. s. p. existing in the high-pressure starting space 12 just suffices for starting.

FRANZ NEUGEBAUER.
PAUL MÜLLEJANS.

PUBLISHED JUNE 15, 1943. BY A. P. C.

P. MÜLLEJANS ET AL

STARTER FOR FREE PISTON MOTOR COMPRESSORS

Filed Nov. 12, 1941

Serial No. 418,666

2 Sheets-Sheet 2

Fig. 3

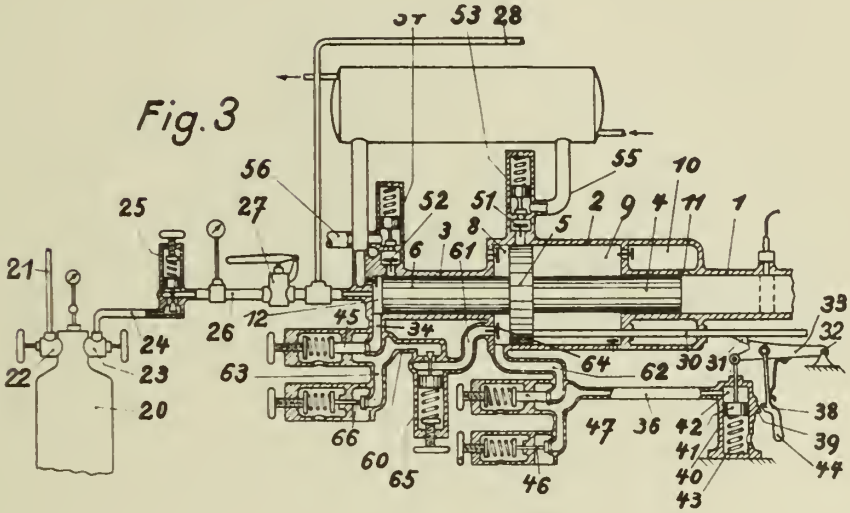
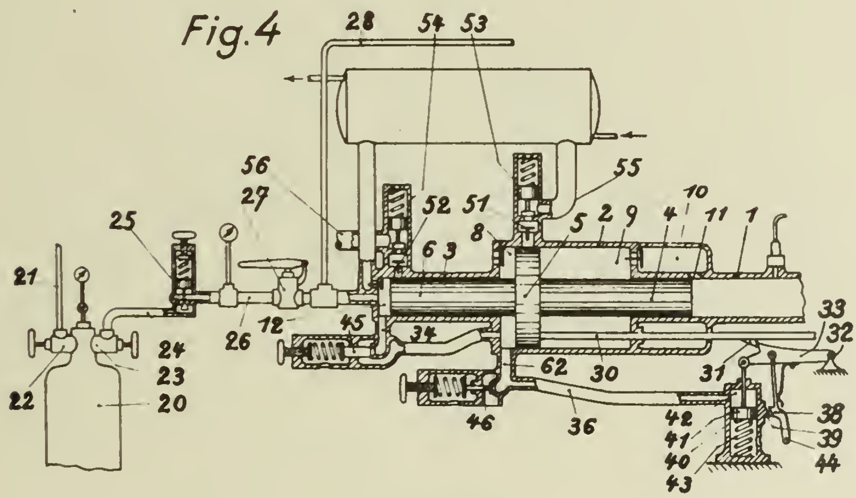


Fig. 4



Inventors:
Paul Müllejans and
Franz Neugebauer
by Paul Fishburne
Attorney

PUBLISHED
JUNE 15, 1943.
BY A. P. C.

P. MÜLLEJANS ET AL

STARTER FOR FREE PISTON MOTOR COMPRESSORS

Filed Nov. 12, 1941

Serial No. 418,666

2 Sheets-Sheet 1

Fig.1

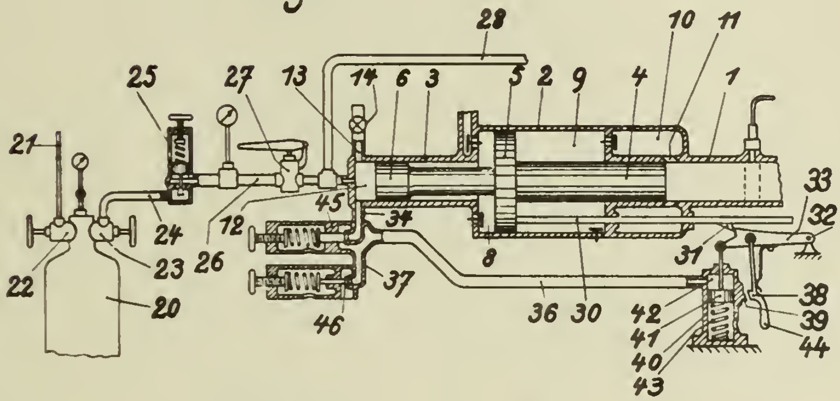
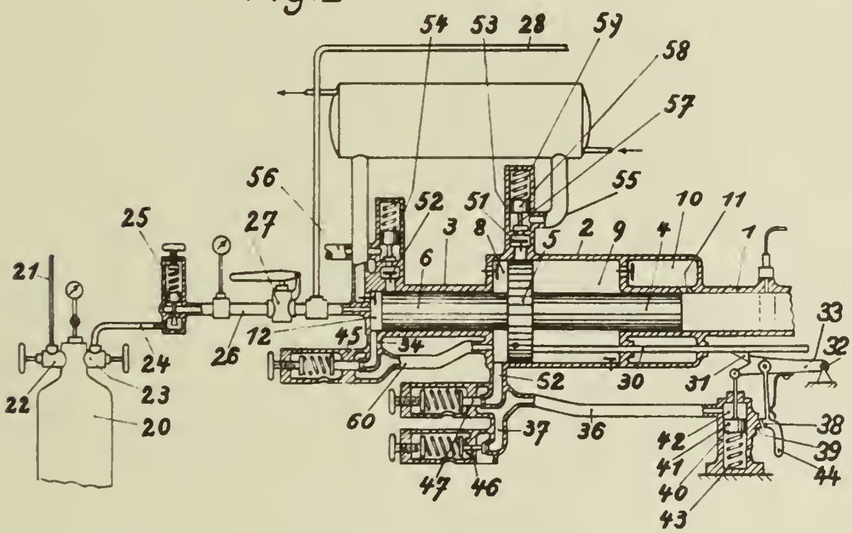


Fig.2



Inventors:
Paul Müllejans and
Franz Neugebauer
by
Attorney

Published June 15, 1943

Serial No. 420,312

ALIEN PROPERTY CUSTODIAN

MACHINES FOR MANUFACTURING ROTATION OR REVOLUTION BODIES

Eugène Fouquet, Clermont-Ferrand, France; vested in the Alien Property Custodian

Application filed November 24, 1941

The object of the present invention is to provide a method and a machine for machining rotation of revolution bodies, and particularly for manufacturing the ribs of air-cooled aviation engine cylinders.

At present, the machining of the ribs of air-cooled engine cylinders is effected by simple or multiple lathe tools. This method, however, is long and costly. Furthermore, large difficulties are encountered during the machining, due, on one hand, to the comparatively short distance between adjacent ribs, and, on the other, to the reduced thickness of the cylinder walls. Besides, the steels used for making the cylinders are specially treated for increasing their hardness, so that the cutting tools will frequently break and, even if the greatest precautions be taken for the machining operation, the later will always be lengthy and delicate. It will further be noted that it is impossible to make the distance between adjacent ribs as small as desirable since it is impossible to reduce the width of the tools below a given value without further increasing the risk of breaking the tools.

The present invention has the object of remedying these drawbacks. It provides a very rapid and precise machining while the distance between adjacent ribs may be made smaller as has been possible up to the present.

The method according to the invention consists in effecting the machining of the ribs by means of multiple grinders consisting in elementary grinders spaced from one another by a number of spacing members and arranged on the same axis.

The method is further characterised by a continuous or non-continuous grinding of the grinders themselves, effected on the machine carrying the grinders.

To this effect, the machine according to the present invention comprises a multiple grinder at least, accompanied by a corresponding device adapted to grind the grinder itself and hereafter called the grinding device, the axis of which is parallel to the grinder axis, the grinder and grinding device being movable on the machine frame so that they may be moved towards or away from one another.

In a practically advantageous embodiment, the machine comprises two multiple grinders or grinder sets, called the primary and secondary, acting on either side of the cylinder on which the ribs are to be formed, simultaneously or in succession, and associated each with suitable grinding or forming members. The primary and secondary grinders have in principle different diameters and one may use as secondary grinders the primary grinders after they have been partially worn out.

The movement of the grinders, both the main grinders and those of the grinding members, towards or away from one another, the variations in the speed of rotation of the main grinders and of those of the grinding device in accordance with the sequence of operations to be performed may be obtained in principle automatically by means of electromagnetic relays actuated by checking members supervising the execution of the job.

The machine is preferably designed in such a manner that said checking members will come to action only when the job they supervise is near its completion.

The machine may further comprise a servo blocking device, movable perpendicularly to the cylinder and grinder axes and comprising the required parts for clamping and freeing the parts maintaining in place the cylinder, the grinders and the grinding devices.

Several other characteristics of the machine will appear from the following specification relating to two embodiments chosen by way of example and represented on the joined drawings, in which:

Figures 1 to 6 refer to a first embodiment, which is particularly simple and non-automatic.

Figure 1 is an elevation with section along the line I—I of Figure 2 and with the support partially torn away.

Figure 2 is a plan view corresponding to the preceding figure, with a section along the line II—II of Figure 1.

Figure 3 is a detail showing in elevation a movable head stock.

Figure 4 is a section along the line IV—IV of Figure 2.

Figure 5 is a partial plan view with a section at an enlarged scale, showing more particularly the mounting of the cylinder to be machined, the multiple grinder and the mounting of the grinding device.

Figure 6 is an elevation corresponding to Figure 5.

Figures 7 to 15 refer to a second machine operating automatically.

Figure 7 is a general elevation, in front view.

Figure 8 is a rear view without the protecting cover.

Figure 9 is a longitudinal section showing the

casings for the mechanisms driving the various carriages.

Figure 10 is a transverse section through the points A—B—C—D—E—F—G and H of Figure 9, showing the cylinder carrying and primary grinders carrying spindles in section.

Figures 10*a* and 10*b* concern details of a free-wheel bearing of one of the driving motors.

Figures 11 and 11*a* are diagrammatic elevations for explaining the operations of the cams associated with the control members.

Figure 12 shows at a larger scale a detail of a part of Figure 8, certain parts being left away for permitting a better understanding.

Figure 13 is a sectional elevation perpendicular to Figure 12.

Figure 14 shows in detail, at a larger scale, a part of Figure 8, and

Figure 15 shows, also at a larger scale, a detail of the right hand side of Figure 9.

In Figures 1 to 6, the machine comprises a main frame 401 on which a carriage 402 is movable longitudinally. On this carriage is mounted a motor 403 which may drive the shaft 404 or cylinder carrying shaft. The rotation is obtained by means of a gear 408 keyed to the shaft 404 (Figure 1), a gear 409, a gear 410 and a gear 411 keyed to the same shaft, and of a pinion 412 keyed to the shaft of motor 403. The whole mechanism is protected by a casing 413.

On the shaft 404 is centered the cylinder 427 to be machined, the centering being effected (Figures 2 and 5) by cones 405, 407 locked by a nut 405 screwed on a thread of shaft 404.

The shaft 404 is supported on one hand by a fixed head stock 425 fixed to the carriage 402, and on the other hand by a movable head stock 424 (Figures 1, 2, 3), the lower part of which is provided with a dovetail groove and movably mounted on a correspondingly formed rib 423 arranged transversely on the carriage 402. This movable head stock 424 may thus be moved towards the outside for allowing the cylinder 427 constituting the job to be inserted on the shaft 404. A screw 426 is provided for blocking the movable head stock 424 in the required position.

The longitudinal movements of the carriage 402 are obtained by means of a rack 417 blocked to the carriage by the screw 418 (Figure 1) and meshing with the pinion 419 keyed to shaft 420 which is mounted in the bearing 422 integral with the frame 401. The shaft 420 is actuated by means of the hand-wheel 421. The frame (Figure 4) carries a projecting rib 415 of dovetail form, on which is movable a carriage 402 fitted with a corresponding groove 414.

On the frame 401 of the machine and towards the middle of the latter are marginally arranged bearings 428, 429 for a shaft 430 carrying the multiple grinder indicated as a whole by 431. The bearing lids 428, 429 are hinged to the corresponding parts for facilitating a dismounting of shaft 430 and displacement of the grinder 431. The grinder 431 consists in a series of grinding elements 431*a* separated by spacing members 432, the diameter of which is such that they do not hinder the grinding of the grinder itself op to the extreme limit. A spacing bushing is provided in 434 on the shaft 430, and the grinders 431*a* and spacing members 432 are engaged alternately on a hub 436 keyed to the shaft 430, a threaded ring 435 screwed on a thread of shaft 430 maintaining the whole arrangement in position. The rotation of shaft 430 is obtained by means of a single or multiple belt 438 driven by a motor 439 fixed to the base plate of the machine.

The frame 401 further comprises a second carriage, or grinding carriage 440, to which is fixed a motor 441 driving over a belt 442 a shaft 443 carrying the grinder 444 of the grinding device. This grinder consists in a pile of steel discs adapted for grinding the multiple grinder 431. The shaft 443, together with shaft 404, is carried on one hand in a fixed head stock 445 integral with the carriage 440, and on the other hand in a head stock 446 which is movable in a transverse direction with respect to the movement of the carriage 440 on the frame 401.

The guide of carriage 440 comprises a longitudinal groove 448 in which is movable a nut 449 integral with the carriage 440 and engaging the thread of a shaft 450 carrying a pinion 451 meshing with another pinion 452 keyed to a threaded shaft 453 parallel to shaft 450. The shaft 453 carries a thread engaging a nut 454 movable only longitudinally in the groove 416 in which is also movable the rack 417 of carriage 402. The nut 454 forms a stop for the carriage 402 as will be indicated further below. On the outer end of shaft 450 is mounted freely a worm wheel 456 which may be coupled to the shaft 450 by a bushing 458 angularly coupled with the shaft 450 with which it may be moved along. The bushing 458 is provided with a control hand-wheel 459. The worm wheel 456 meshes with a screw 460 moved by hand through the means of hand-wheel 461.

The operation of this machine is as follows:

After fixing the cylinder 427 to be machined on the shaft 404, the various motors are started up and, by acting upon the hand-wheel 421, the carriage 402 is progressively moved towards the multiple grinder 431. This movement is limited by the nut 454 forming a stop. After machining a cylinder 427, the latter is taken off the machine and replaced by another. Before effecting a new grinding, the grinder 431 itself is ground. For this, the hand-wheel 461 is actuated in order to approach the carriage 440 to the grinder, the grinding wheel 444 then effecting the desired grinding. It will be noted that the displacement of carriage 440 has set up a movement of the stop 454 by the same amount but in the opposite direction. Under these circumstances, it is possible to effect a perfectly precise grinding of the cylinders since the grinding will be ended each time the carriage 402 strikes against the stop 454.

The uncoupling of the worm wheel 456 by means of the bushing 458 permits to move the grinding wheel 444 back by acting upon the hand-wheel 459.

One will now describe the automatic machine shown on Figures 7 to 15.

This machine comprises essentially, on the frame 1, the following parts suitably cooperating for machining a cylinder 15;

A set of primary grinders 21, or primary multiple grinder,

A set of secondary grinders 126, or secondary multiple grinder,

A wheel 52′ for grinding or shaping the primary multiple grinder, and

A wheel 112 for grinding or shaping the secondary multiple grinder.

For describing the various devices ensuring the required cooperations, one will first examine the various carriages (cylinder, primary grinder, secondary grinder and grinding wheel carrying carriages) and the parts they carry, and thereafter the control parts, the devices used for accounting,

when moving the grinding wheels, for the wear of the grinders, and lastly the servo blocking device.

Cylinder-carrying carriage

This carriage 3 (Figures 9 and 10) moves longitudinally in a dovetail groove 2 provided in the main frame 1 (Figure 10). The carriage is provided with a bore in which is arranged the spindle 4 rotating on one hand in the bearing 5 and on the other hand in the bearings 6 and 7.

This spindle 4 receives the cylinder 15 to be machined and maintained in place by a split socket 16 engaging a conical support 17 and actuated by a nut 18. The latter receives its longitudinal movement from a screw 19 integral with an apertured plate 20.

The rotation of spindle 4 is obtained by means of the bevel wheel 8 meshing with pinion 9 which is keyed to shaft 10 provided with longitudinal grooves and coupled by means of keys 11, in rotation with the sliding socket 12 which receives its motion from the helical wheel 13 driven by the motor 14 driving a guide-screw not visible on the drawing. It is clear that owing to this slidable drive, the vertical distance between the spindle 4 and the shaft of motor 14 may be varied at will.

The longitudinal displacements of the cylinder carrying carriage 3 are obtained, with two different speeds, in the following manner (Figure 9):

On the shaft of an electric motor 68 is keyed a pinion 69 meshing with a gear 70 on the shaft of which are arranged a pinion 72 and a gear 73 (Figure 13). The pinion 72 meshes with a larger gear 75. The gear 73 meshes with a gear 74 of same size. The gears 74 and 75 are both keyed to the tangent screw 81 (Figure 15) meshing with the two-piece pinion 76 provided with a slack absorbing device of a known type, such as that shown by way of example and comprising two toothed half rings 77 and 78, the half ring 78 forming a nut 85 on shaft 86, and the half ring 77 being pivoted on 78 and permitting to take up the slack by means of the bolt 79 and coil spring 80 which may move the two toothed half rings 77 and 78 by an amount equal to the slack existing in the thread of the tangent screw 81.

It is clear that the transmission from motor 68 to pinion 76 may be effected at two different speeds according as to whether it is performed over the wheels 72 and 75 (low speed), or over the equal wheels 73 and 74 (high speed). The speed is determined in a known manner by a sliding dog clutch 82 coupling either wheel 72 or wheel 73 with the corresponding shaft, the movements of the dog clutch being obtained by means of a fork 83 fixed on the shaft 84 and actuated in a known manner by an arrangement of electromagnets which has not been shown for simplicity.

The endless screw 86 is coupled by a cone with a support 87 fixed to the carriage 3 by screws 89 and 90.

Primary grinder carrying carriage

Like the cylinder carrying carriage, this carriage 50 moves in the dovetail groove 2 of the main frame (figure 10). The bore of this carriage receives the spindle 28 revolving in the ball bearings 29 and held axially by thrust bearings 30. The spindle 28 carries a thread 27 on which is screwed the hub 22. This hub 22 is fitted with a primary multiple grinder 21 arranged between a fixed flange of the hub 22 and a movable flange 23, the individual or elementary grinders being clamped by means of a washer and the toothed nut 25, this nut also carries slots 28 for blocking the whole on the thread 27.

The other end of spindle 28, carried by a support 32 through the means of a ball bearing 33, carries a pulley 31 on which passes a belt 34 which is also passed over the pulley 31*a*.

The drive of spindle 28 is effected either at a high speed or at a low speed by the motors 35 and 41 (figures 8 and 10). The shaft 36 of motor 35 (figure 10) is coupled in rotation, by means of a key, with pulley 31*a*. The shaft 36 carries an extension 37 rotating in the free-wheel rollers 38 shown in detail in figures 10*a* and 10*b*. The outer rolling path 38*a* is coupled in rotation with the socket 40 to which is keyed the ring 39 driven by the endless screw 42 driven in turn by the motor 41. Normally the extension 37 driven by the shaft 35 rotates in the bearings 38, but when, owing to the starting up of motor 41 and to the slowing down of motor 35, the ring 38 tends to rotate faster than the extension 37, the rollers 38*b* are locked in their casing thus causing the extension 37, shaft 36 and pulley 31*a* to be driven by the motor 41 which is the low speed motor.

In order to permit a tightening of the belts 34, the motors 35 and 41 (figures 8 and 10) are fixed to a general support 43 which may be moved by the screws 44, 45 driven together by the endless screws 46 and 47 acting upon the nut forming pinions 48 and 49.

Secondary grinder carrying carriage

This carriage 92 (figure 9) carrying the secondary multiple grinder 126 mounted on the spindle 125 rotating, owing to the bearings 124, in the bore 123, is movable longitudinally on the cylinder carrying carriage 3 by means of a slide 93 at the end of which is fixed the slack absorbing nut 94. The nut 94 may receive a longitudinal movement from a screw 95 rotating without longitudinal movement in the bearings 97 and 98 held in a supporting bearing 96 which is fixed in a suitable manner to the carriage 3. The axis of the screw 95 is extended by a grooved shaft 99 (figure 15) which may be driven in rotation by pins 100 and 101 with slack absorbing devices by partial rotation. These pins are integral with the hub 102 of the pinion-nut 103 formed by two pieces like the pinion-nut 76 and similar to the latter. This pinion is in mesh with the screw 104 driven by a screw gear 105 of a known type driven itself by a motor 106 fixed to the main casing 107 (see figures 8 and 9).

The rotation of the grinders 126 carried by the secondary grinder carrying carriage 92 is obtained as follows: (figure 8):

On the spindle carrying the multiple grinder 126 is fixed a pulley 127 connected by a belt 128 to a driving pulley 129 which may be driven at two different speeds, as described for motors 35 and 41, either by motor 130 (high speed) or by motor 131 driving the screw gear 132 (low speed). The connection of the motor group 130 and 131 with the secondary grinder carrying carriage 92 is effected by an extendable connecting rod 133 formed of two parts, one integral with the motor flange 130 and the other with the carriage 92. Guiding studs 135, 135, prevent both parts of the extendable connecting rod to play transversely with respect to one another, and a screw with opposed threads 134 permits a more or less thor-

ough tightening of the belt 128. This extendable connecting rod 133 urges the motor group 130, 131 into the one or other direction according to the relative motion of the cylinder carrying carriage 3 and the secondary grinder carrying carriage 92. The motor group 130, 131 is, indeed, pivoted to the shaft 137 resting on one hand in a bore of the frame 1 and on the other hand on a overhung table 138 fixed to the support 139.

Grinding carriages

There are two such carriages: the grinding carriage 52 for the primary grinders and the grinding carriage 108 for the secondary grinders.

The grinding carriage 52 for the primary grinders moves longitudinally with respect to the primary grinding carriage 50 by means of a slide 51 provided in this carriage. The grinding carriage carries the grinder 52′ keyed to the shaft 53 housed in its bore 54. The movements of the primary grinding carriage 52 with respect to the primary grinder carrying carriage 50 are obtained as follows:

The carriage 50 in integral with a support 115*a* in the conical bore of which is blocked by the nut 116*a* the cone forming the end of a screw 55 engaging with a slack absorbing two-piece nut 56, 57 forming a pinion with helicoidal teeth, similar to pinion 76 already described. The nut-pinion 56—57 is driven by a tangent screw 58 which may be rotated either by a high speed motor 59 or by a low speed motor 60, corresponding to two different speeds for the motion of the grinding carriage 52 with respect to the primary grinder carrying carriage 50.

For the high speed, the pinion 62*a* keyed to the shaft of motor 59 drives the gear 65*a* mounted on shaft 66*a* which rotates in turn the wheel 67*a* keyed to the same shaft 66*a* and driving at the same speed the wheel 68*a* keyed to the shaft of the tangent screw 68.

For the low speed, the screw 64 keyed to the shaft of motor 60 drives tangentially the wheel 65 on the shaft of which is keyed the wheel 67 driving in turn the wheel 66 mounted on the shaft 66*a*, whence the motion is transmitted as before, over 67*a*, to the wheel 68*a* and to the tangent screw 58. For passing from one speed to another it is therefore necessary that the coupling of shaft 66*a* be transferred from one of the wheels 65*a* (high speed) and 66 (low speed) to the other. This is obtained in a known manner by means of a slide gear actuated by a fork movable on the axis 63 and actuated by two (not shown) electro-magnets arranged one in front, the other at the rear and supplied with current at the required moments.

The secondary grinding carriage 108 carrying the grinder 112 fixed to shaft 111 arranged in the bore 110, is movable longitudinally, by means of a suitable slide, on the secondary grinder carrying carriage 92.

The motion of carriage 108 with respect to carriage 92 is obtained as follows:

The carriage 108 carries a support 115 provided with a conical bore in which is inserted a cone 114 blocked by the nut 116. The cone 114 forms the end of a screw 113 engaging a nut-pinion 117, 118 similar to the nut-pinion 76. This nut-pinion is driven in rotation by the screw 119 driven in turn by a worm gear 120 and a rocking motor 121 pivoted to the machine frame (see Figure 8). This motor drives the group, whatever its position, by means of a grooved slide 122, 122*a*.

Checking members

The supervision of the machining operations is effected by means of feelers actuated only when the various operations to be checked by them are about to be ended. Two such feelers will be described here by way of example, although they may be provided in any desired number.

The two feelers are indicated respectively by 140 and 141 (see Figures 7, 8 and 9). They are both keyed on a common shaft 148 mounted in a casing 147 fixed to the cylinder carrying carriage 3. On the shaft 148 is also keyed the gear 149 meshing with pinion 150 integral with wheel 151 driving pinion 152 on the shaft of which is keyed a rotating disc of insulating material carrying a conducting segment 154 which closes or opens a circuit, according to its position with respect to the contact blades corresponding to the terminals 155, 155′.

On the primary grinder carrying carriage 50 is fixed a guide 146 in which is slidable a cam 145 carrying a groove 144 engaged by a stud 143 of a protection lever 142 integral with the feeler 140. The cam 145 may come to strike against the casing 147.

The feeler 141 is integral with the protecting lever 156 resting on a cam 157 slidable in the guide 158 fixed on the secondary grinder carrying carriage 92. The cam 157 may also come to strike, by one of its ends, against the casing 147. The other end of the cam 157 may act as a stop for a feeler 159 through the means of an intermediate part 280, the mounting of which will be explained later.

The feeler 159 is provided with a rack meshing with a pinion 160 integral with the gear 161 driving the pinion 162 integral with the gear 163 driving, through the means of a pinion, the insulating disc 164 provided with a conducting segment 165 cooperating with the contact blades connected to two terminals of a circuit, these two terminals occupying different positions with respect to the segment 165 according to the position of the rack feeler 159. The movement of the latter, at the other end of the cam 157, is limited by the adjustable stop 166.

Devices for taking into account, in the motion of the grinder carrying carriages, the wear of the grinders

It is clear that the movements of the grinder carrying carriages with respect to the corresponding multiple grinders must be so much greater as the wear of the grinders increases. This is obtained by limiting the movements of the grinder carrying carriages by means of adjustable stops and displacing said stops automatically in terms of the wear of the grinders.

In the case of the primary grinder carrying carriage 52, the amplitude of its displacement is determined by the movement of the cylinder carrying carriage, since it is the cylinder carrying carriage and not the primary grinder carriage that moves during the work.

An adjustable support 167 is fixed by screws 168 on the cylinder carrying carriage 3. This support (see particularly Figure 12) comprises a slack absorbing nut 170 in which is screwed the feeler 169 carrying a not threaded extension 171 in which is formed a longitudinal groove 172 adapted to receive a (not visible) key of a ratchet 173 provided with a pawl 173*a*. It will be seen that the ratchet 173 is coupled in rotation with the feeler 169 and permits a longitudinal motion

of the latter. The ratchet 173 is arranged between the arms of a bracket 174 fixed to the machine frame by screws 175. This bracket also carries two parallel bores 178, 179 in which is movable the shaft 180 pivoted on the other hand in the supports 181, 182 fixed to the carriage 3. To shaft 180 are keyed the support 173*b* of pawl 173*a* and lever 183 carrying an inclined place 181*a* on which a roller 183*b* may roll, the threaded shaft 183*a* of which engages a dovetail slide of frame 1, in which moves a slide 182 carrying on the other hand a stop 183 cooperating with the feeler 169. The slide 182 further carries a rack 183*a* (Figure 8) meshing with a gear 186 without slack, driving the rack 187 fitted with a stop and sliding in the supports 188, 189 fixed to the machine frame 1.

The primary grinder carrying carriage 52 further carries a casing 190 called the amplifying casing, traversed by a feeler 192. This feeler is provided with a rack 193 meshing with pinion 194 belonging to the wheel 195 which is in mesh with pinion 196 driving, over another gearing, the insulating disc 197 to which is fixed the conducting segment 198 cooperating with the contacts of terminals 199 and 200.

The operation of the whole device is easily understood:

As the wear of the grinder increases, the cylinder carrying carriage 3 must come, for its work closer and closer to the shaft of the primary grinder 21. The shaft 180, carried along by carriage 3, accordingly moves over a larger distance with respect to the frame, the incline 181*a* advances with respect to the roller 183*b* and comes to roll over it. The lever 183 is thus rocked and rocks in turn the shaft 180 and the support 173*b* of the roller. The roller 173*a* causes the wheel 173, and with it the shaft 171, to rotate. The threaded feeler 169 is thus moved with respect to the support 167 and consequently with respect to the carriage 3. This move is transmitted, in the opposite direction, through slide 182, from wheel 186 to the stop 187. Thus, it is seen that the length of path of feeler 192, determining the length of the displacement of the carriage, has been increased.

Concerning the motion of the secondary grinder 112, its adjustment is obtained as follows (Figure 14):

The intermediate part 280 is integral with a rack meshing with a gear 281 mounted on a shaft 281*a* held by an extension 281*b* belonging to the guide 158 of the secondary grinder carrying carriage. The wheel 181 is in mesh with a rack 157*a* of the slide-cam 157.

As the wear of the secondary grinder 126 increases, its carriage will come, during operation, closer and closer to cylinder 15. Under these circumstances, the casing 147 will repel the cam 157, which, through rack 157*a* and wheel 281, moves the intermediate part 280 in the direction of arrow 5. The effect is the same as if the cam 157 had been shortened, with a corresponding increase in the stroke of feeler 159.

Servo blocking device

This device serves the purpose of clamping the cylinder and grinders in position on the various carriages and comprises a support 201 fixed to frame 1 by bolts 202 (Figure 7 to 10). The support carries a socket in which is engaged the cantilever pivot 203 carrying the plate 204 on which is mounted the motor 204*a*. The casing of this motor is integral with a bevel gear casing 205 for transmitting the motor drive to the horizontal shaft 206. The latter carries a pinion 207 (Figure 10) meshing with a bevel wheel 208, in the hub of which is slidable a grooved shaft 209 driven in rotation by the bevel wheel 208 by means of keys 210 integral with the hub. The hub itself is rotatable in the bearing 211 of casing 212 (Figures 7 and 10). The casing itself forms a slide on the cantilever bar 242.

The casing 212 carries an outer thread on which is engaged the inner thread of a nut-casing 219 fitted with a lateral extension 222 in which is mounted the screwing and unscrewing shaft described below. The pitch of the thread carried by the nut-casing is such that one half revolution of this casing causes the screwing and unscrewing shaft to rise or sink by an amount corresponding to the vertival distance between the axis of the cylinder spindle and the axis of the primary grinder carrying carriage spindle. It has been found indeed that this slight displacement of said axes with respect to one another is favourable for certain jobs.

The nut casing 219 may occupy two positions diametrically opposed with respect to casing 212. To this effect, an outer flange of the nut-casing carries two conical apertures 220, 221 into which may penetrate a locking bar 213 movable in a perforation of casing 212. This locking bar carries a rack 214 meshing with a gear 215 actuated by a control lever 216. A not shown spring urges the lock into downward direction. It is clear, that by acting upon lever 216, the lock 213 may be pulled clear from aperture 220, after which the casing 219 will be moved over half a circle with respect to casing 212 and the lock 213 permitted to return into the aperture 221.

The cylinder carrying extension 222 has an outer diameter which is slightly smaller than the inner diameter of cylinder 15, in order to permit an easy application of the latter on the former. The extension contains a bearing 223 on which rests a ring 224 provided with a shoulder, carrying the ball thrust bearing 225 and receiving the push of spring 226, this spring resting on the other hand on a collar 227 of a slotted driving bushing 228 which is brought to mesh, by spring 226, with the hub 229 of a gear ring 230 meshing with the conical pinion 231 keyed to the end of shaft 209. The wheel 230 rests on the thrust bearing 232 held by the ring 233.

The hub 229 is engaged by a hollow shaft 234 grooved on the outside. The grooves of this shaft cooperate with corresponding inner grooves of the hub so that the shaft 234 is driven in rotation while being freely slidable longitudinally and may be pulled or pushed at will by the operator.

At one end, the hollow shaft 234 carries a plate 236 provided with pins 236 which may engage in apertures 20 of bushing 19 mentioned above. At the other end, the shaft carries a ring forming a key 237 for slackening the threaded hubs of the primary and secondary grinders, and also of the grinding wheels. The hollow shaft 234 further contains a hexagonal key 228*a* driven in rotation by the shaft.

In Figure 10 it may be seen how the operator may pass form the tightening of slackening position for the cylinder, to the position for tightening or slackening the grinder. For this, he will exert a pull on shaft 234 in order to disengage the pins 236 from the apertures 20. He will then act upon the lever 16 for disengaging the

lock 213 from the bore 220, after which he will rock the whole arrangement in order to bring the ring 237 into the position occupied by the disc 235 and vice-versa. It is then merely necessary to push the ring 237 in a manner that its slots engage the slots 26. Once this coupling effected, the hexagonal key 228*a* is pushed to engage a corresponding housing provided at the end of the grinder carriage spindle. The operator will then start the motor 204*a* which, through the transmission described above, will drive the hollow shaft 234 in the unscrewing direction. As soon as the grinder 21 is slackened, the operator takes off the ring 237 and inserts in its place the primary grinder 21.

On the rectangular cantilever 242 is longitudinally movable, as indicated, the slide constituted by casing 212 (Figure 7). To this effect, the slide comprises rollers 260, 261 and 262, 263 which may roll in longitudinal V-shaped grooves formed on the bar 242 (see Figure 10). A (not shown) brake, actuated by lever 259, permits to stop the slide in any desired position of the length of bar 242.

The bar 242 is normally maintained in operating position by a support 244 (Figure 10) fixed to a protecting cover plate 245. One may also rock this bar about the pivot 203 in order to bring it outside of the operating field. For this, it is only necessary to act upon the lever 238 locking the bar, integral with the shaft 239 pivoted in the support 244 and receiving the bolt 241 which maintains the bar 242 in a housing provided in the support 244.

The protecting cover 245 is screwed to the frame 1 and comprises a sliding door 246 balanced by a counterweight 247, 248 hung to the cables 249 passing over pulleys 250.

Inside the protecting cover are arranged (Figure 7) cooling coils 253, 255, 257, 259 connected by hose to a source of liquid and controlled by valves 252, 254, 256, 258.

For permitting the operator a constant control of the various parts of the machine, the frame has been provided with a desk fitted with all the switches and other control gear necessary for following the operation of the machine.

For effecting the various adjustments necessary in operation, a number of hand-wheels 270, 271, 272, 273 have been provided, keyed to the required shafts, acting through the levers 274 and 275 (Figure 7) onto the dog clutches and thus permitting an actuation by hand of all the parts of the machine.

Operation of the machine

The operation of the machine will be described, by way of example, in the particular case where it is used for machining ribs, with successive operation of the primary and secondary grinders, and where the feelers 140 and 141 serve respectively for checking the work at the bottom of the grooves and on the outside of the ribs.

Supposing the cylinder 15 and the multiple grinder 21 occupy the positions shown in Figure 4, the operator first of all rocks the cantilever 242 out of the machine field, after having set it free by acting upon the locking lever 238. He then closes the flap 246 and thereafter performs the necessary adjustments.

For well understanding this adjustment, one should refer to Figures 11 and 11*a*. On Figure 11, the parts have been shown in the position to which they are brought for adjustment, i. e. in which the grinder 21 is tangent to the cylinder 15. The pin 143 of the protecting lever 142 lies in the lower straight part of the groove 144 of cam 145 slidable in the supporting carriage 50 of the primary grinder carrier.

The operator then chooses a gauge having for instance 0.5 mm less than the depth of the ribs to be obtained, and places this gauge between the casing 147 and cam 145. He then moves the cam 145 towards the casing 147 until casing and cam are both in contact with the gauge. The work is then started. Towards the end of the work, the parts occupy the positions of Figure 11*a*. The pin 143 has attained the upper horizontal part of groove 144. As long as the pin 143 remained in the slanting part of the groove, the protection lever 142 maintained the feeler 140 at a certain distance from the job to be checked, thus being protected during the greater part of the work of the primary grinders. When the work of the primary grinders is about to be ended, i. e. when the depth of the grooves between ribs is equal to the distance AB, the pin 143 is no longer retained and the feeler 140 comes into contact with the place of work of the grinders.

After having adjusted the mutual positions of the sliding cam 145 and casing 147, the machine is started up. The sector 154 touches the blades 155′ and thus establishes the circuits in such a manner that the primary multiple grinder rotates at high speed and that the cylinder carrying carriage advances at low speed.

When the amount of machining performed is such that the feeler 140 will attain the required position, the insulating disc 153 will have moved by such an amount that the conducting segment leaves the blades of terminals 155′ and comes in contact with the blades of terminals 155, with the following results:

1. The current in motor 68 is reversed, while under the action of the suitable electromagnet the sliding gear 82 is simultaneously brought into the position corresponding to high speed. The carriage 3 consequently moves back, rapidly clearing the primary multiple grinder.

2. The motor 106 is supplied with current in the direction corresponding to an advance of the secondary grinder carrying carriage 92 over the carriage 3, so that the secondary multiple grinder comes to action on the cylinder. The secondary grinders will for instance round off the apex of the ribs. This operation is checked by the feeler 141 of the protecting lever 156, the duty of which is, similar to that of the protecting lever 142, to free the feeler, so that it may come into contact with the rib apex, only when the ribs are about to be ended.

3. Current has been sent through the motor 59 and the suitable electromagnet has brought the dog clutches in position corresponding to high speed, so that the grinder carrying carriage 52 has moved on the carriage 50 to high speed position. This move goes on until the feeler 192 (Figure 2) comes into contact with the stop 187. At this moment, the segment 198 of the insulating disc 197 set in rotation by the rack 192 comes into contact with the blade of the suitable terminal for actuating the required electromagnet and bringing the dog clutch into the low speed position, while the low-speed motor 60 is supplied with current. Under these conditions, the grinder 52′ grinds the primary grinders 21.

4. The latter rotate slowly. Indeed, owing to the movement of the conducting segment 154, the current has been cut off in motor 35 and set up in motor 41. As soon as the speed of motor 35 has

fallen below that of motor 41, the free wheeling device 38 is set in action, with the effect that the pulleys 31*a* are now driven by motor 41, and these pulleys drive, over the intermediate parts described, the grinders 21 at low speed.

With such a machine, it is possible to obtain conical ribs in one or more operations.

One side of the ribs will for instance be cut by the primary grinders with the required rounding off at the bottom of the groove. The other side will be cut together with the corresponding rounding off at the bottom of the groove, by the secondary grinders. The grinders will then be changed and replaced by such in form of a cone cut at the slope required for the rib. It will thus be possible to obtain the conical ribs.

For permitting the forming of conical ribs with a single set of grinders, a certain advantage is obtained if the cylinder axis 15 is displaced with respect to the grinder axis 21 as shown on the drawings, in order to prevent any clogging. The resulting deformation of the ribs may be compensated on the grinder grinding the grinder itself, causing it to give the grinder a correspondingly altered shape.

EUGÈNE FOUQUET.

PUBLISHED

JUNE 15, 1943.

BY A. P. C.

E. FOUQUET
MACHINES FOR MANUFACTURING ROTATION
OR REVOLUTION BODIES
Filed Nov. 24, 1941

Serial No.
420,312

10 Sheets-Sheet 1

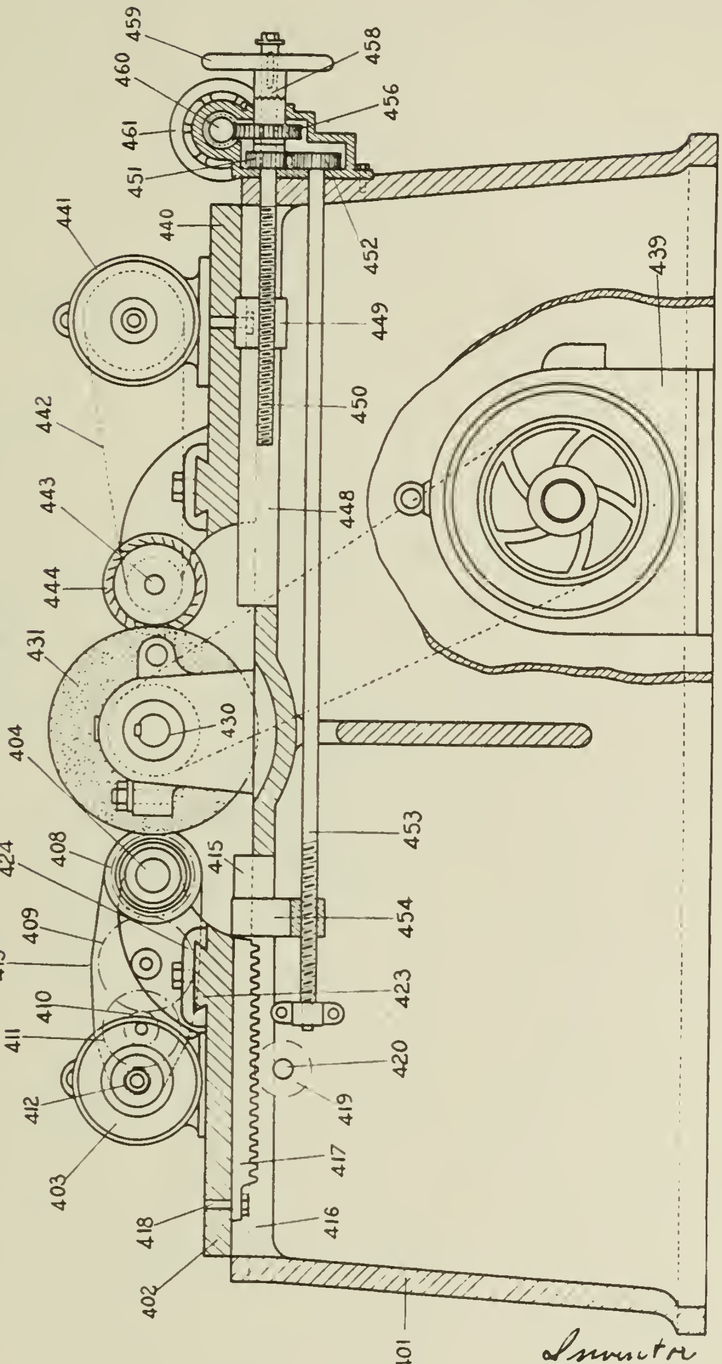


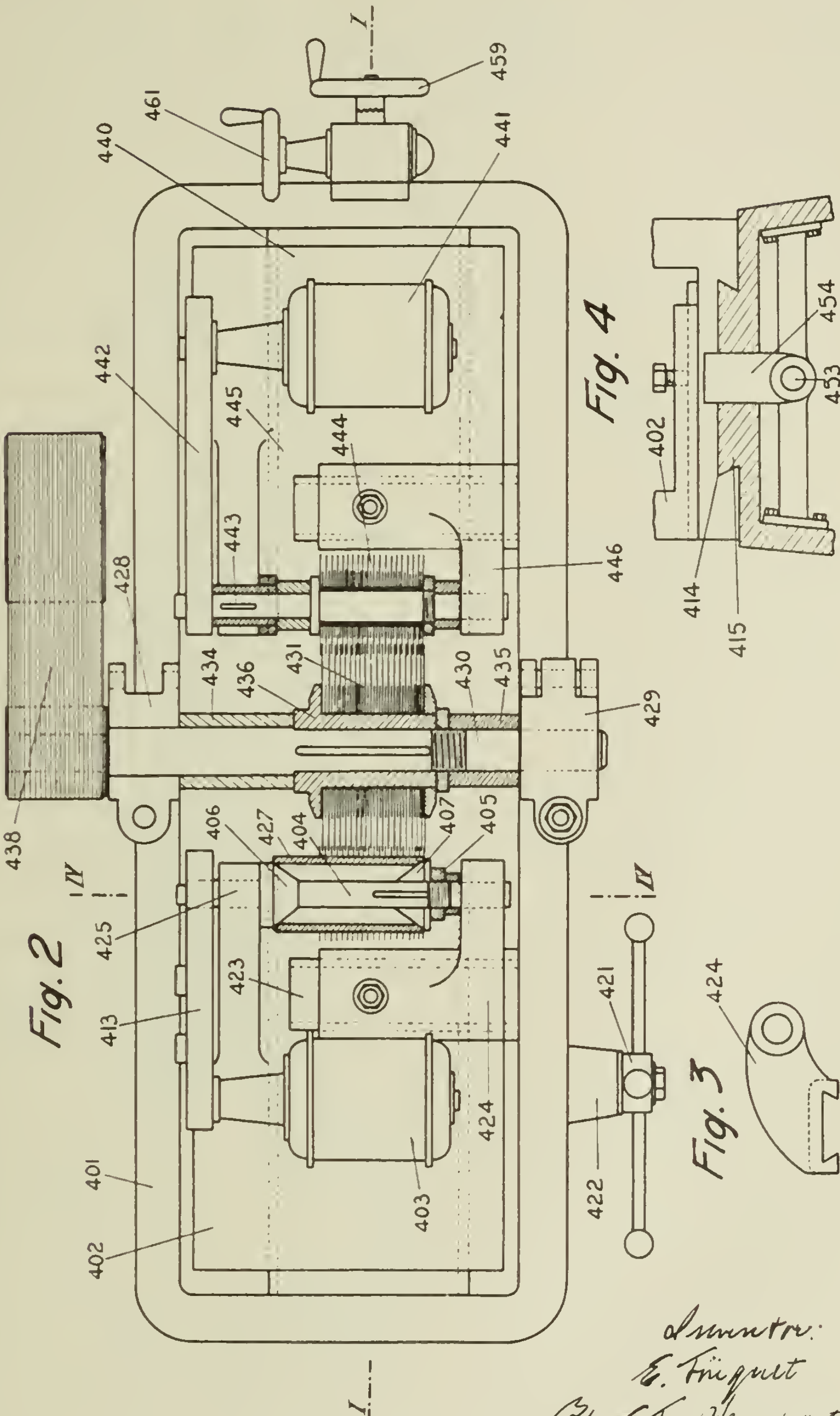
Fig. 1

Inventor
E. Fouquet.
By E. F. Wenderoth Atty

PUBLISHED
JUNE 15, 1943.
BY A. P. C.

E. FOUQUET
MACHINES FOR MANUFACTURING ROTATION
OR REVOLUTION BODIES
Filed Nov. 24, 1941

Serial No.
420,312
10 Sheets-Sheet 2



Inventor:
E. Fouquet
By E.F. Wenderoth
Atty

PUBLISHED

JUNE 15, 1943.

BY A. P. C.

E. FOUQUET
MACHINES FOR MANUFACTURING ROTATION
OR REVOLUTION BODIES
Filed Nov. 24, 1941

Serial No.
420,312

10 Sheets-Sheet 3

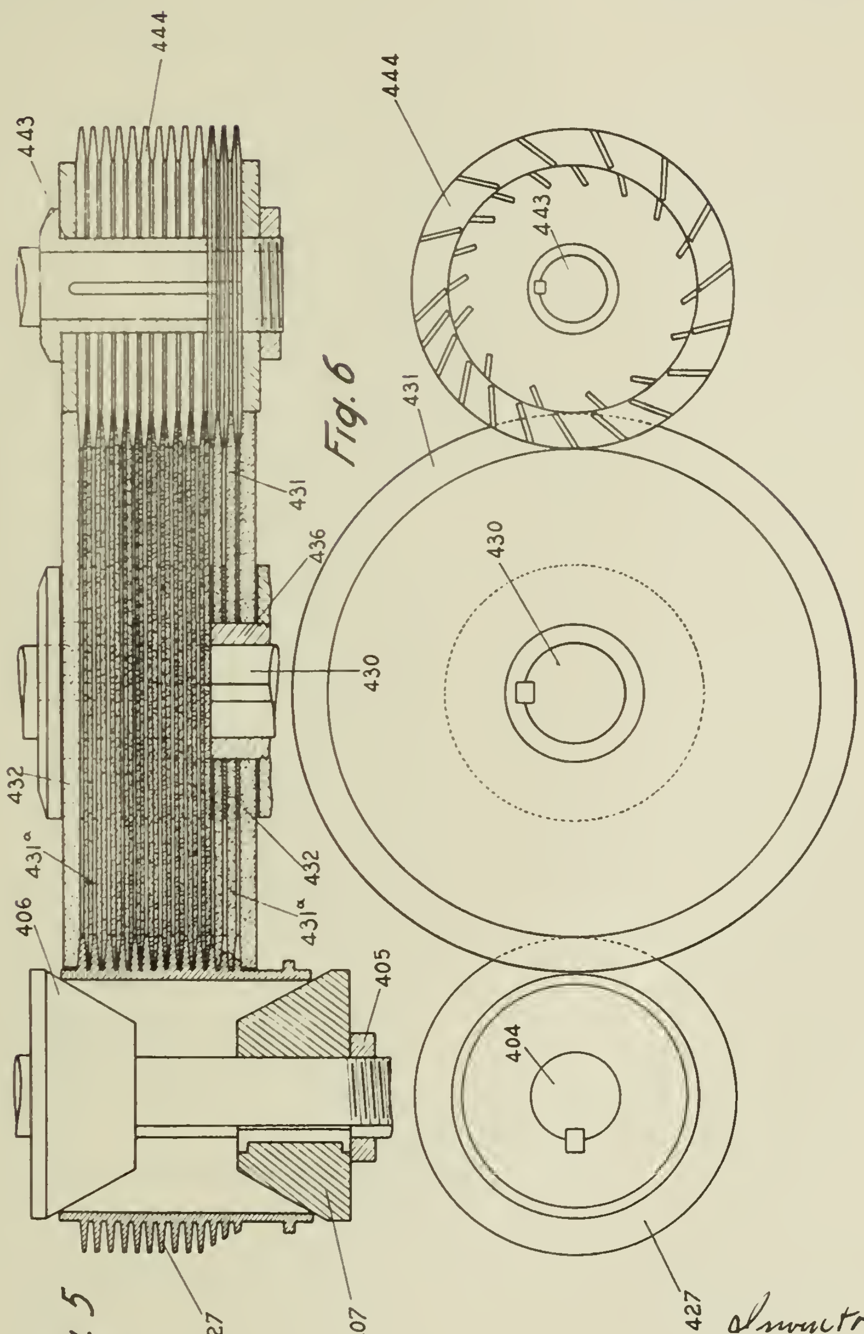


Fig. 5

Fig. 6

Inventor:
E. Fouquet
By E. F. Wenderoth
Atty

PUBLISHED

JUNE 15, 1943.

BY A. P. C.

E. FOUQUET
MACHINES FOR MANUFACTURING ROTATION
OR REVOLUTION BODIES
Filed Nov. 24, 1941

Serial No.
420,312

10 Sheets-Sheet 4

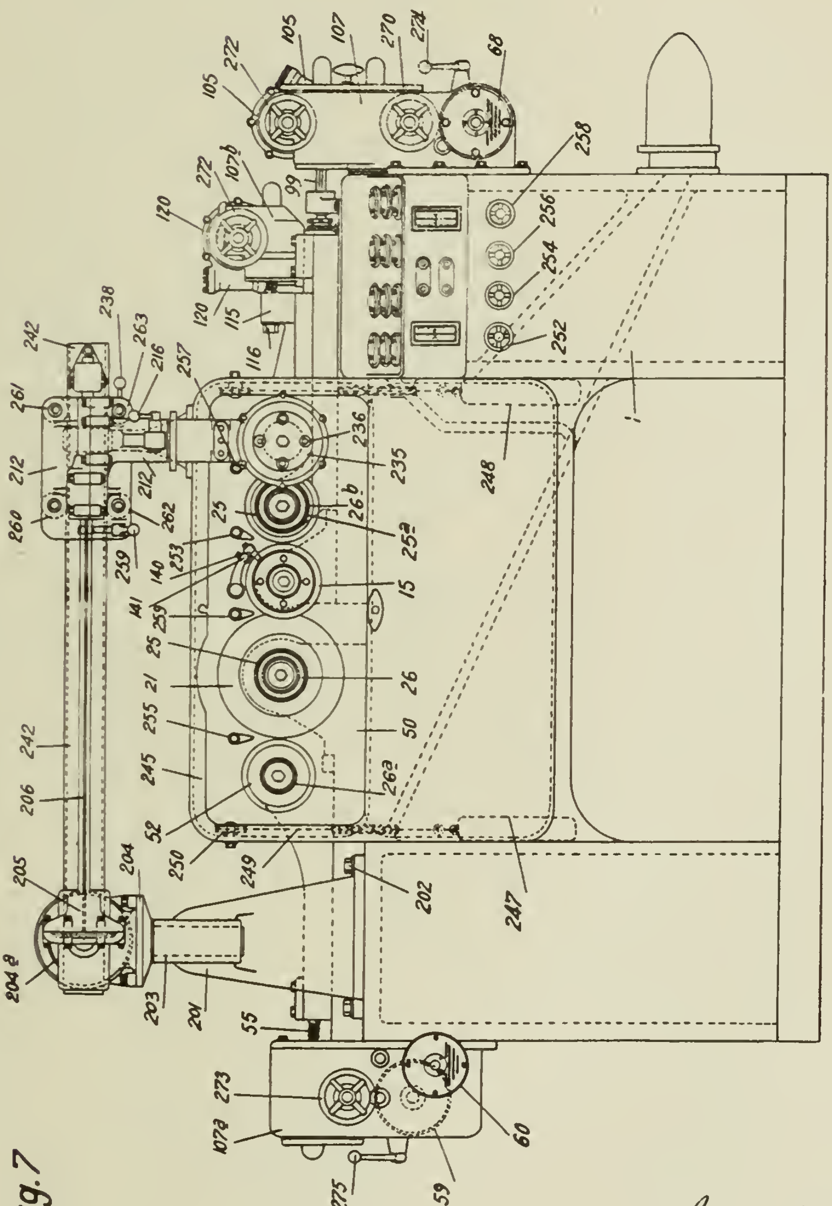


Fig. 7

Inventor:
E. Fouquet
By E. F. Wendworth
Atty

PUBLISHED

JUNE 15, 1943.

BY A. P. C.

E. FOUQUET

MACHINES FOR MANUFACTURING ROTATION OR REVOLUTION BODIES

Filed Nov. 24, 1941

Serial No. 420,312

10 Sheets-Sheet 5

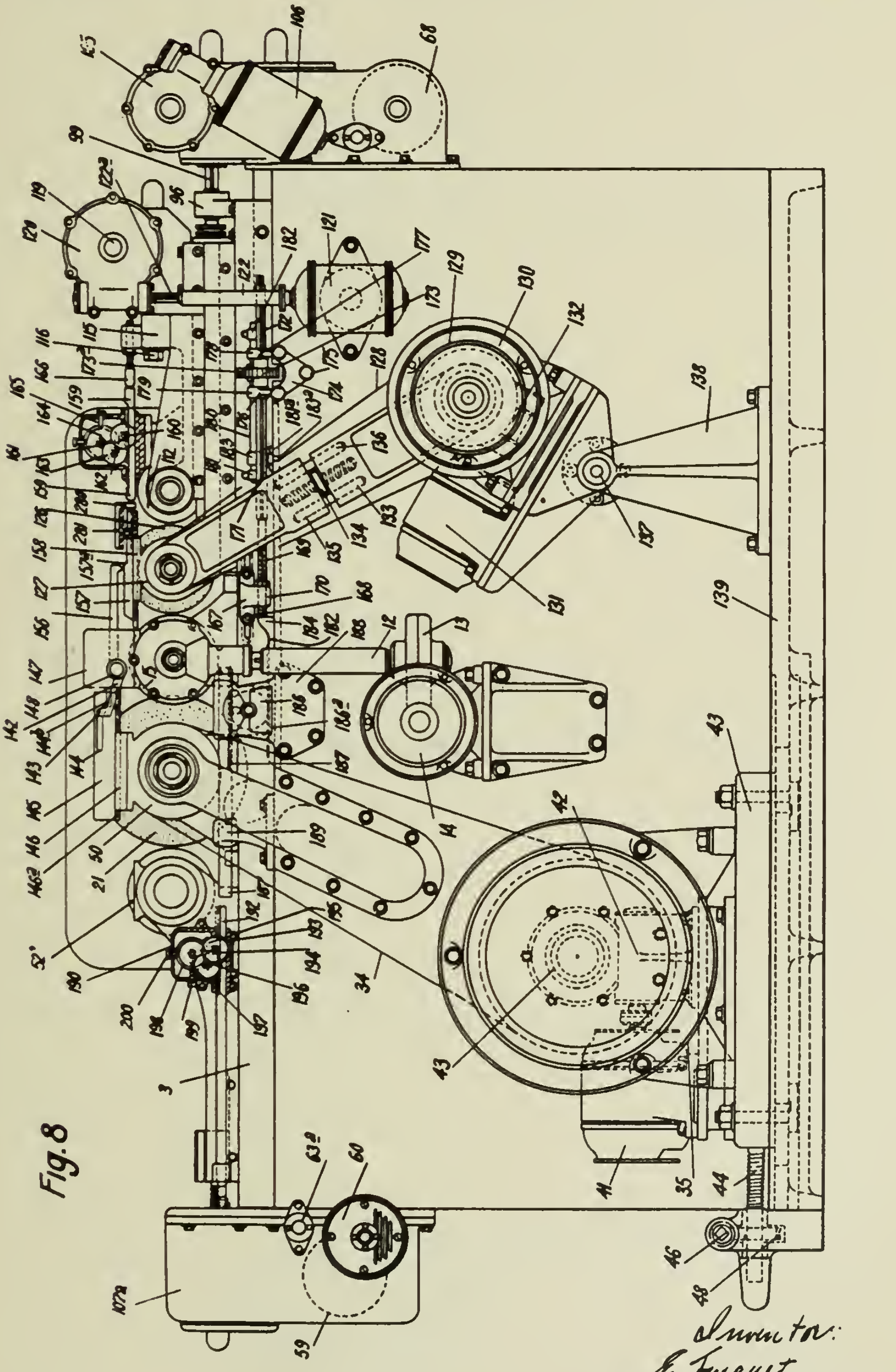


Fig. 8

Inventor:
E. Fouquet
By E. F. Wenderoth Atty

PUBLISHED

JUNE 15, 1943.

BY A. P. C.

E. FOUQUET

MACHINES FOR MANUFACTURING ROTATION
OR REVOLUTION BODIES

Filed Nov. 24, 1941

Serial No.
420,312

10 Sheets-Sheet. 6

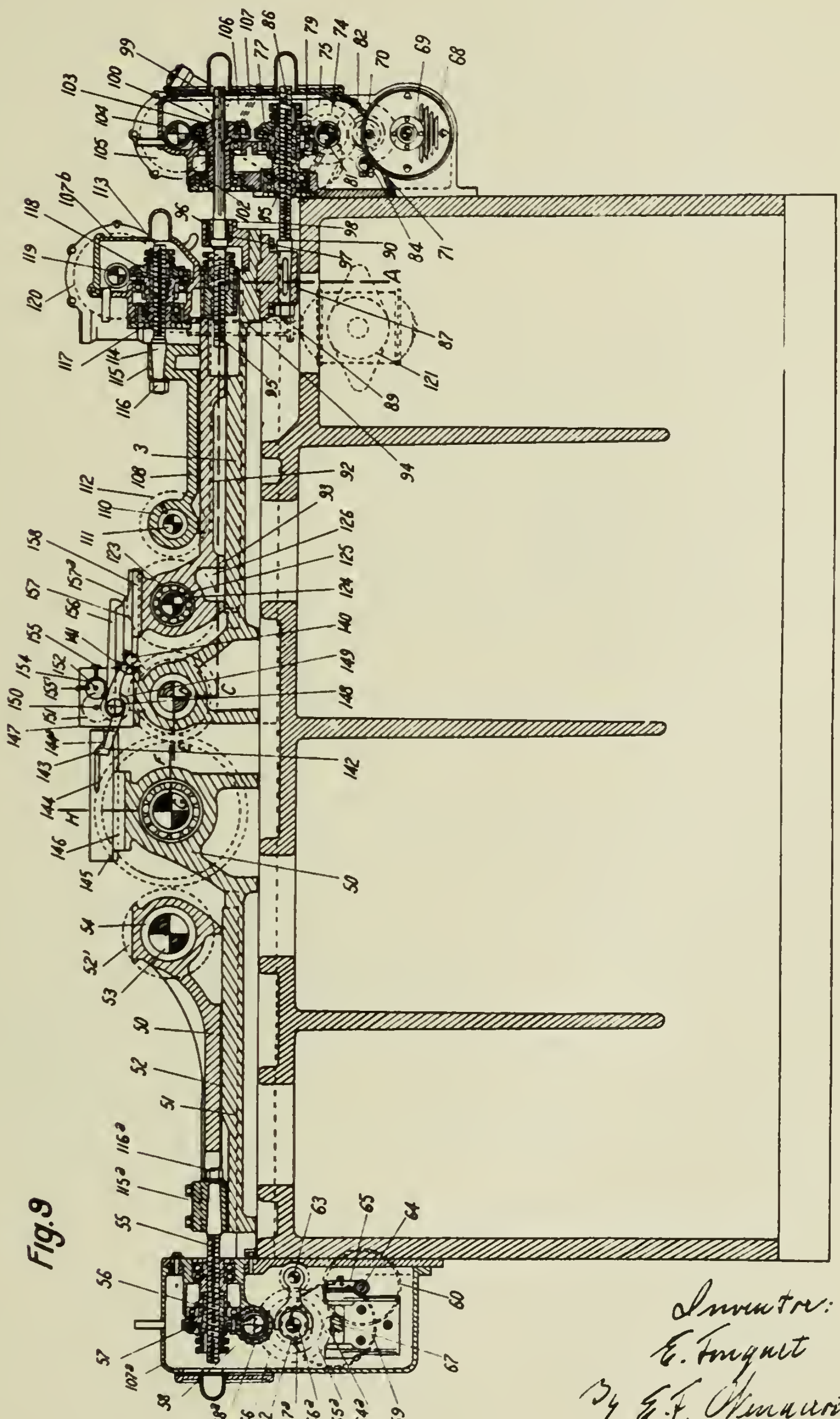


Fig.9

Inventor:
E. Fouquet
By E. F. Wenderoth
Atty

PUBLISHED

JUNE 15, 1943.

BY A. P. C.

E. FOUQUET
MACHINES FOR MANUFACTURING ROTATION
OR REVOLUTION BODIES
Filed Nov. 24, 1941

Serial No.
420,312

10 Sheets-Sheet 7

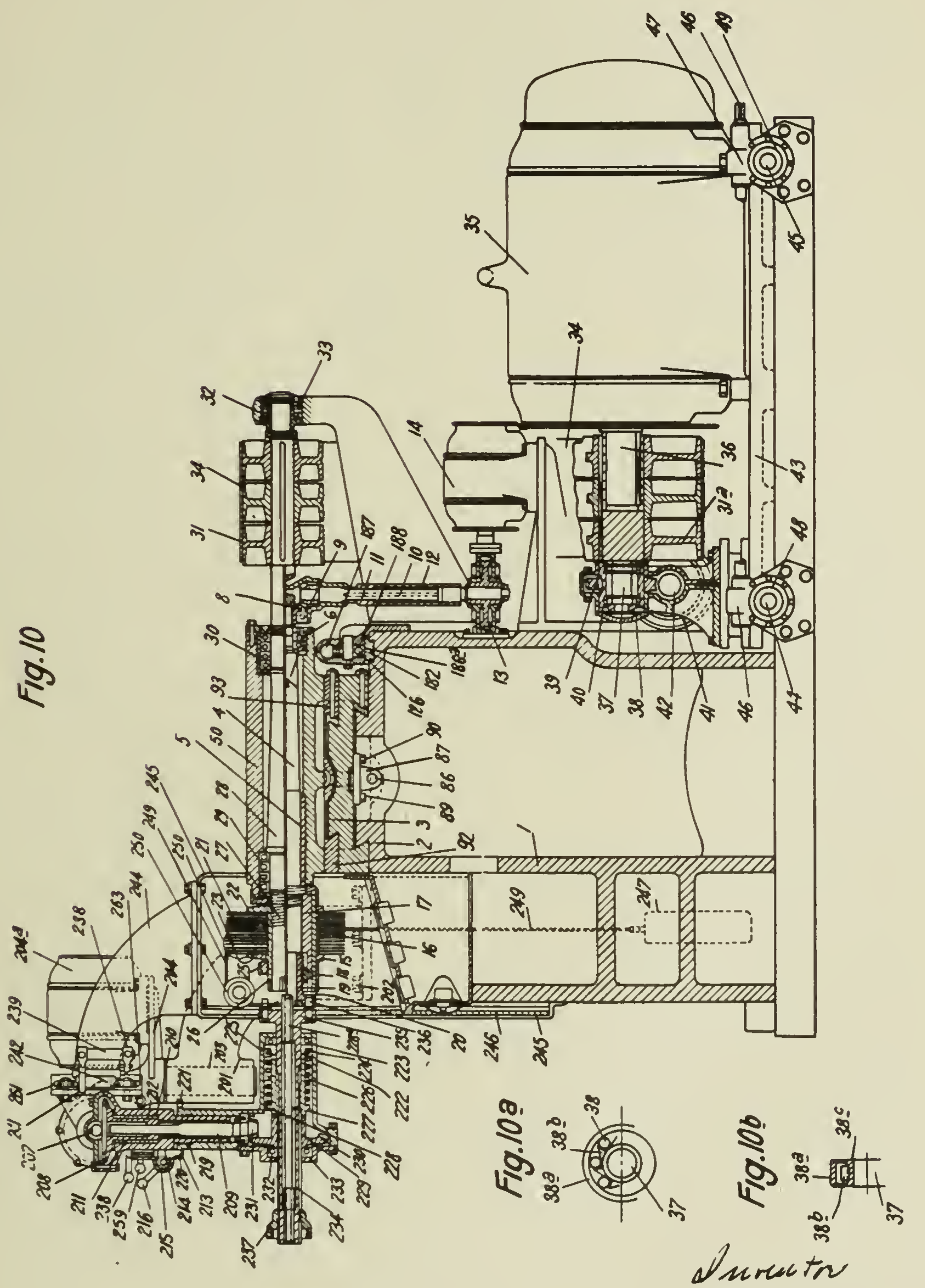


Fig.10

Fig.10a

Fig.10b

Inventor
E. Fouquet
By E. F. Wenderoth Atty

PUBLISHED

JUNE 15, 1943.

BY A. P. C.

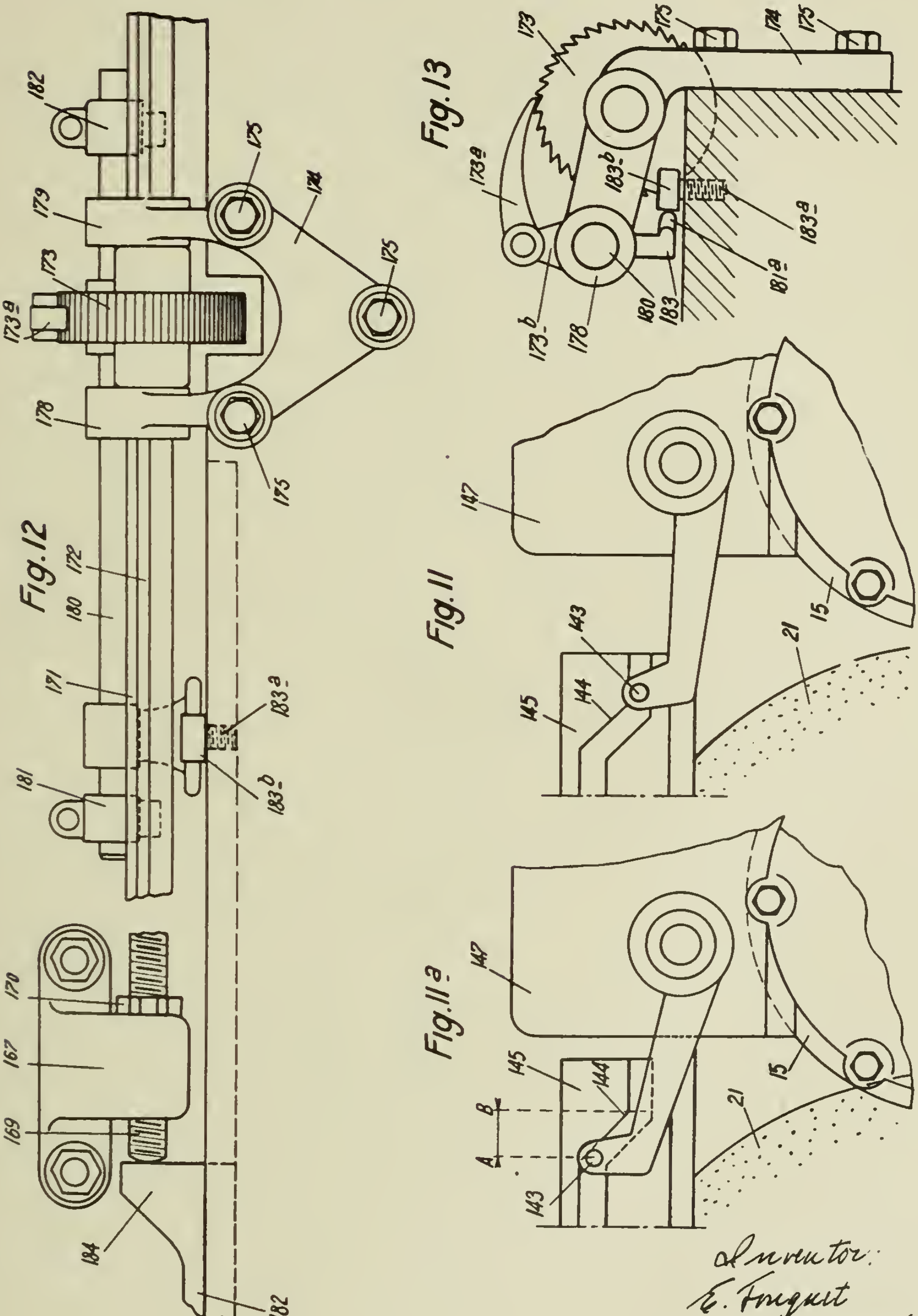
E. FOUQUET

MACHINES FOR MANUFACTURING ROTATION OR REVOLUTION BODIES

Filed Nov. 24, 1941

Serial No. 420,312

10 Sheets-Sheet 8



Inventor:
E. Fouquet
By E. F. Wenderoth
Atty

PUBLISHED

JUNE 15, 1943.

BY A. P. C.

E. FOUQUET
MACHINES FOR MANUFACTURING ROTATION
OR REVOLUTION BODIES
Filed Nov. 24, 1941

Serial No.
420,312

10 Sheets-Sheet 9

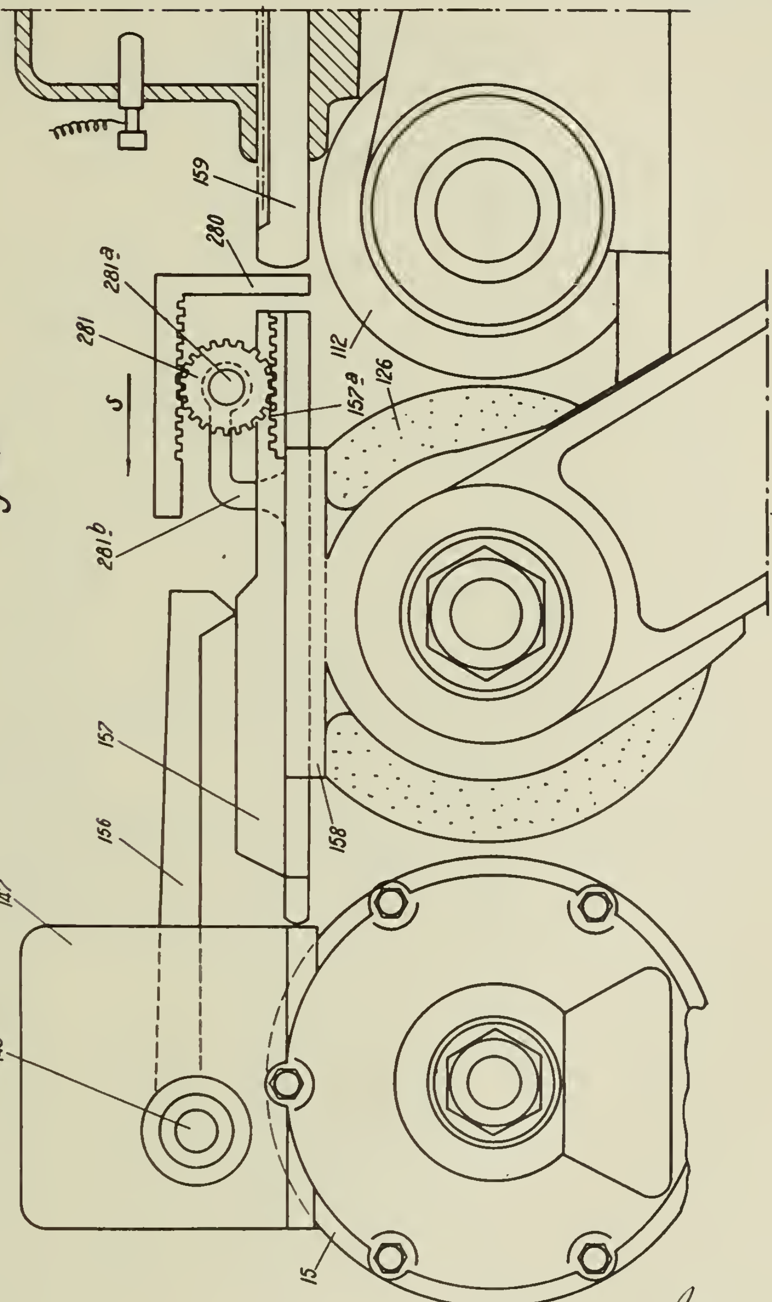


Fig. 14

Inventor
E. Fouquet
By E. F. Wenderoth Atty

PUBLISHED

JUNE 15, 1943.

BY A. P. C.

E. FOUQUET

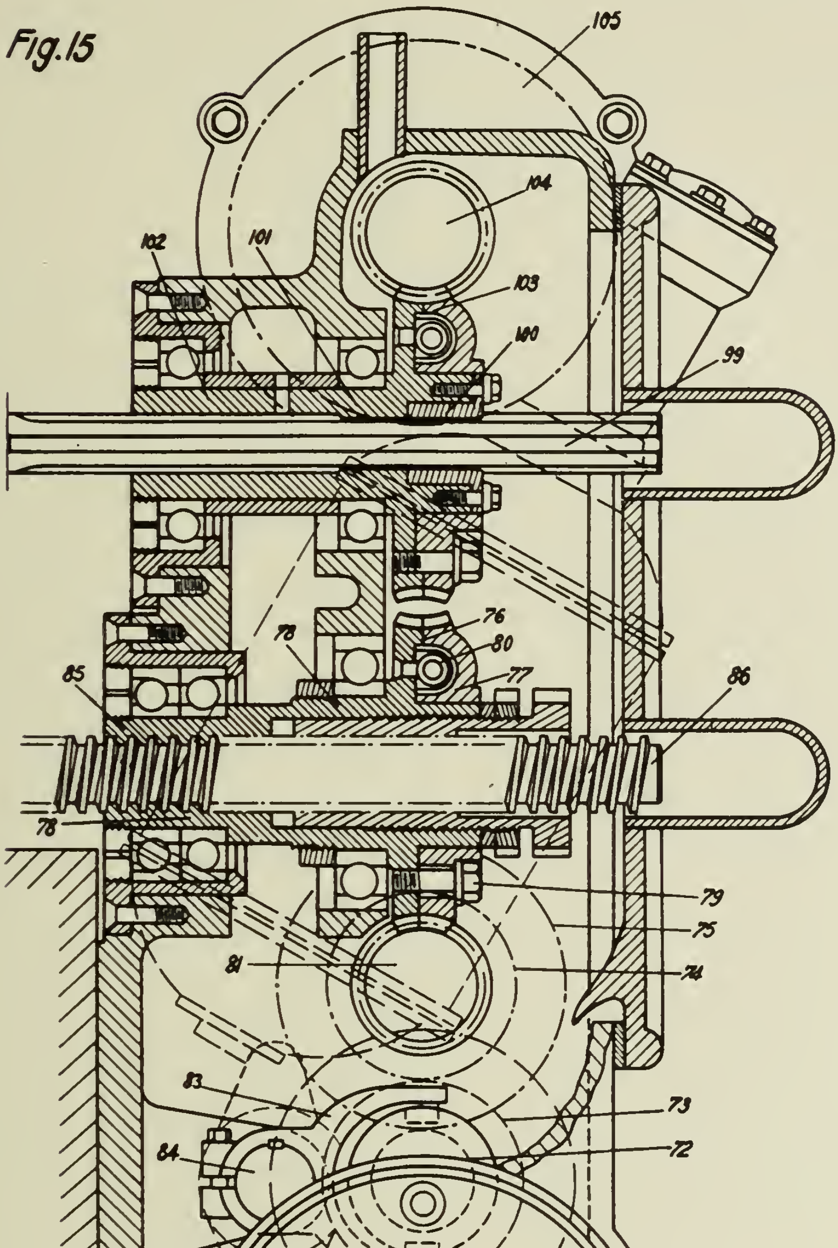
MACHINES FOR MANUFACTURING ROTATION OR REVOLUTION BODIES

Filed Nov. 24, 1941

Serial No. 420,312

10 Sheets-Sheet 10

Fig. 15



Inventor:
E. Fouquet
By E. F. Wenderoth
Atty

Published June 15, 1943 Serial No. 420,313

ALIEN PROPERTY CUSTODIAN

GRINDING MACHINES

Eugène Fouquet, Clermont-Ferrand, France; vested in the Alien Property Custodian

Application filed November 24, 1941

The present invention concerns a grinding machine for machining and forming metal or other jobs by means of grinders, and more particularly for machining by means of cut-in grooves, slicing, and surfacing by means of thin grinders assembled on a same hub.

This machine, designed for permitting a very rapid rotation of the grinders, comprises a multiple grinder carrying member fitted with a slide capable of effecting, along the machine axis, a very rapid reciprocating motion, and further a job carrying table which may be driven, on one hand, transversely to the machine axis, in a very fast reciprocating motion, and, on the other hand, in a more or less fast reciprocating vertical motion according to the nature of the work to be carried out.

The advantage of the high speed of the reciprocating motions of both the slide and the job carrying table, of the order of at least 1 metre per second, consists in particular in the fact that the place of work on the job moves very quickly, thus facilitating the elimination of the heat generated by the work of the grinder.

The grinder carrying member comprises a number of parts adapted to receive the grinders and to cause them to rotate at different speeds. In principle, besides, it will be advantageous to transfer from one grinder carrying spindle to the other the same grinder when its diameter has changed under the effect of its wear. Thus, one may first place on a so-called primary spindle a grinder with a large diameter. When this grinder has been partially worn out, it will be transferred to a so-called secondary spindle, rotating with a speed adapted to its new diameter. The grinder may finally be transferred to a spindle rotating at a very high speed.

One spindle at least is mounted on an arm capable of being rotated with respect to the slide of the grinder carrier while taking part in the reciprocating motion of the slide, and this for bringing said spindle into the suitable position for the work of the grinder placed upon it.

In order to permit very rapid displacements of the table in its reciprocating motion, the latter is supported on its frame by ball bearings of a special design described below.

The working speed of the machine, especially in scraping out jobs, is such that it necessitates a device permitting to fix in advance the depth of the work to be performed by the grinder and to stop the machine or to reverse its movement when the desired cut is obtained. The movements of the operator are, indeed, generally not sufficiently fast, thus causing the risk of overrunning the desired depth, or stopping the machine too early in the absence of an automatic stopping device.

Various other auxiliary devices are provided, such as an indicator of the amount of wear, permitting to account, at any moment, for the wear of the grinder; an auxiliary grinding device permitting to round off the main grinder before commencing work, or to modify its diameter in the course of work, or further, in the case of multiple grinders, to maintain them all at the same diameter by causing the auxiliary grinder to act upon those which are less worn out, in order to reduce their diameter to the size of the smaller ones; a periscope for supervising the work; and a device allowing to effect with the same machine surfacing jobs by means of inclined crossed lines.

Other features of the present invention will appear from the following specification relating to an embodiment chosen by way of example, with reference to the joined drawings, in which:

Figure 1 is a front elevation of a machine fitted with an auxiliary spindle rotating at high speed.

Figure 2 is a side elevation with a simple spindle and large diameter grinder in work position on the primary spindle.

Figure 3 is a sectional elevation through the line I—I of Figure 1, showing the general drive of the machine, passing through the axis of the primary spindle and then through the table axis. The lower part of the secondary grinder carrier is shown in work position with its feeler and periscope in dotted lines.

Figure 4 is a general front view of the machine with section through the secondary spindle and the longitudinal axis of the table and gear box.

Figure 5 is an outside view at a larger scale of the grinder case, with the dials of the control apparatus and of the wear indicator, the auxiliary grinder and the periscope being also shown.

Figure 6 shows the same device, partially in section, with the lid of the transmission members removed.

Figure 7 is a partial transverse section of Figure 6 through the axis of the latter and then through the grinder axis.

Figure 8 is a partial section of Figure 6.

Figure 9 is a section at a larger scale of the control apparatus.

Figures 10 and 11 show details of the contact control of Figure 9.

Figure 12 is a diagram illustrating the principle of surfacing by multiple grinders operating by crossed lines, and

Figure 13 is a diagrammatic plan view of a roller bearing of the table.

The various combinations of parts constituting the machine will now be described in succession.

Device for driving the grinders in rotation

This device consists in an electric motor 1 acting, over a belt 20, on a multiple pulley 21 keyed to a socket 23 mounted, through bearings 106, 107 in supports 104, 105 of a stool 108 fixed, as explained further, to the frame 12 of the machine.

The motor 1 may be lifted or lowered with respect to the frame for correctly tightening the belt 20. For this, bearings 11 support a vertical screw 10 driven in rotation by a bevel gear 13, 14 from a shaft 15 mounted in bearings 16, 18 and on which is keyed a control hand wheel 19.

The thread of screw 10 is in mesh with a nut 9 integral with pins 7, 8 engaged in blocks 5, 6 arranged in slides 3, 4 integral with an oscillating support 2 on which is fixed the motor 1.

Thus, by acting upon the hand wheel 19, the screw 10 will be set in rotation, thus causing the nut 9, together with motor 1, to rise or lower.

Grinder-carrying head

This head, supporting the full cones adapted to receive the grinders, comprises (Figure 3) an axis 26 carrying at one of its ends the spindle 35, called the primary spindle, which is fitted with the grinder when the latter has its largest diameter, and at the other end longitudinal grooves 25 cooperating with keys provided inside the socket 23 so that the shaft 26 may slide freely in this socket but is driven in rotation by the latter and therefore by motor 1.

The shaft 26 is integral longitudinally with a cylinder or arm 46 in which it may rotate by means of ball bearings 28, 29, 30. On the shaft 26 is keyed, by means of a key 33, a helical gear 32 for setting the secondary spindle 37 (Figure 4) in rotation over the wheel 36 keyed to this spindle. The spindle 37 rotates in ball bearings 38, 39. The nut 41 maintains the cage 40 of bearing 39 against a shoulder 42, while cage 44 of bearing 38 and minion 36 are blocked by nut 43. The whole is supported by a cage forming extension of arm 46. The arm 46 (Figure 3) is mounted rotatably in the slide 47 provided with ribs 74 and adapted for protecting the pulleys 21, 22 without being disturbed in its movement by the latter.

The rotation of the cylindrical cage 46 is set up by the helical wheel 48 driven by the endless screw 49 keyed to shaft 50, the rotation of which is set up by a hand wheel 51 (Figure 4). A wedge brake 52 (Figure 3) permits to fix the arm 46 in any desired position. As seen, Figure 3 has been drawn for a certain position of the arm (with the secondary spindle 37 below the primary spindle 26), while Figure 4 shows another position (secondary spindle above the primary spindle); Figure 1 shows a third position and shows how a pulley 321 may be mounted at the end of spindle 37 for driving, over a belt 322, a third spindle 323, or high speed spindle, rotating in the extension of the arm, forming a cage 45, and on which the grinder may be mounted after its diameter has decreased by its work on the primary spindle, followed by work on the secondary spindle.

The slide 47, carrying along with it the cage-arm 46, 45, receives in the axial direction of the machine a very fast reciprocating motion in the following manner: An extension 93 of slide 47 is made, by means of a bolt, integral with the rod 80 of a piston 75 movable in a cylinder 76 fitted at both its ends with stuffing boxes 77, 78 through which passes the rod 80 and its extension 79. Cylinder 76 is fixed to the stool 108 and this is fixed to the cradle 68 (Figure 4) by bolts 109, 109′, and to the cross member 110 by bolt 111. The ends of the cross member are bolted to the sides 101 and 102 of the machine by bolts 112. The cradle 68 itself is fixed to the sides 101, 102 by bolts 103, 103′ (Figure 4). The stool 108 is provided with a bore 113 through which passes a spindle 114 carrying a hand wheel 115 (Figure 2). The object of the latter is to give the stool the required resistance to the pull of the heavy belt 20. The bolts 119, 119′ and 120, 120′ (Figure 3) fix the whole to the support 121.

For determining the movements of piston 75 and therefore of slide 47, a hydraulic control of a known type is used, permitting to introduce a fluid under pressure alternatively in one or other chamber 81 and 83 while it is evacuated from the other chamber. This is obtained by means of a distributor 88 supplied with fluid under pressure from a compressor 85 by the pipe 86 and distributing and evacuating it through the pipes 82 and 84 leading to the chambers 81 and 83. The distributor 88 is of the known type consisting in a chamber in which a rod 89 provided with suitable ports is moved at the ends of the stroke for reversing the fluid distribution. This movement is set up when the rod 89 strikes against the adjustable stops 89′ and 90 carried along in the movements of the slide. The fluid returns to the compressor by pipe 92.

An adjustable valve 87 provided with a divided scale 95 is inserted in the pipe 86 and permits to choke more or less the passage of liquid and thus to adjust the linear speed of the slide.

The reciprocating motion may also be obtained by hand. For this, a by-pass is used, controlled by a hand wheel 96 and permitting to connect chambers 81 and 83, and thus equalise the pressures on either side of piston 75. A hand wheel 97 will then permit to move the rack 98 moving the slide, while fluid passes from chamber 81 into chamber 83 over the by-pass 96, which is closed when it is desired to work with the hydraulic control.

This hydraulic distribution thus permits to obtain a reciprocating motion of the slide 47 with variable speeds, and to adjust, by means of the stops 89′, 90, the stroke of the slide. If it is desired to work with a fixed grinder, without reciprocating movement, the fluid under pressure is sufficient for fixing the position of the grinder, when the valves 87 and 96 are closed.

Job-carrying table

The job to be machined, 64 (Figure 3), is blocked in its mounting 122 which is itself fixed to table 123 by bolts 124 and 125. Between the fitting 122 and table 123 is arranged the emptying channel 126.

The table 123 may be driven into two movements: a first very rapid reciprocating movement (of at least 1 metre per second) perpendicular to the longitudinal axis of the machine, and the other a vertical reciprocating motion for scraping out jobs. On Figure 3, the whole of the table has been shown in the lower position, and the upper part of the table has been shown also

in the upper position, cooperating with the grinder 56 fixed to the secondary spindle.

The to and fro motion of table 123 perpendicularly to the axis is effected at very high speed on ball bearings.

For this, the table rolls on its frame over particular ball bearings, the principle of which is illustrated in figure 13 showing one of these bearings in plan view.

It is supposed that at a certain moment the motion takes place in the direction of arrow F. The balls B are arranged in two straight lines connected by round parts at the ends of the lines. In the round parts, the balls move in open round channels C, C′. In one line, the left line in figure 13, the balls B are carriers and carry the load of the job moving in the direction of arrow F; in the other line, the right one, the load does not rest on the balls and these are, for instance, simply contained in a tube T. The operation of the device is as follows: the load causes the balls B of the left line to move in the direction of arrow F; they roll in this channel C and then pass into the tube T, into channel C′ and resume their place with the carrying balls. When the job moves in the opposite direction, the motion of the balls is, of course, also reversed.

Table 123 (figure 3) carries at its lower part two bars 127, 128 inclined by 45° for instance. Opposite 128 is fixed another bar 129 comprising a rolling path 130, inclined by 90° for instance. In the hollow prism thus obtained are placed balls forming the carrying line of the bearing, while the other line is on the left on the picture. Opposite bar 127 is another bar 137, subjected to the action of a spring 138 bearing against a fixed plate 139. The roller balls, the carrying line of which is inserted between bar 127 and bar 137, are here referred to as 136. A nut 140 permits to block the spring 138.

The table 123 itself rests on the bars 129 and 137 by means of bearings 141, 145 made up in the same manner, with the difference that the non carrying lines are arranged without friction in grooves, 143 for instance, drilled in the lower face of table 123, while on the carrying balls, 141 on the left, for instance, the table rests by means of a V-shaped groove 142.

It will readily be seen how this arrangement permits to take up the slack of the whole device. By unscrewing the nuts 140, of which there are a great number arranged all along the table, the springs 138 will be set free. These springs press the balls 136 against bar 127, and, owing to the slope of the latter, the table 123 will thus be pulled downward and bear upon the carrying balls 141. The same effect is set up on the bars 128 and 129. It is therefore simply necessary to retighten the nuts 140 and the table will be ready for a new operation.

One will now examine the manner in which is obtained the to and fro motion of the table, and this either by means of a hand wheel, by an electric motor or by a hydraulic motor.

The hydraulic drive, which is the usual, is effected in a manner similar to that for the to and fro motion of slide 47, described above. It comprises a cylinder 167 (figure 4) in which is movable a piston 167*a* separating the two chambers 167 and 168. The rods of this piston are connected by the extensions 167*b* to table 123. Chambers 167 and 168 are alternately supplied with compressed fluid by a distributor 170 (figure 1) which may cooperate with the movable and adjustable stops 171 and 172. The distributor 170 is connected on one hand to chambers 167 and 168, and, on the other hand, by two pipes, to the compressor 85, one of these pipes carrying the adjusting valve 173 permitting to vary the speed of the reciprocating motion. The operation is the same as that already described for the reciprocating motion of the slide, i. e. the fluid arriving to the distributor 170 and distributed by the latter to chamber 168 repells piston 167*a* until the stop 172, connected to the movement of the piston, strikes against the axis 170′ of the distributor 170, with the effect of reversing the push of the fluid and thus the direction of motion of the table.

The displacement of table 123 by hand or with the electric motor is set up as follows:

A clutch wheel 150 (figure 1) of the dog clutch type is mounted on an endless screw 151 driving the helically threaded nut 152, the hub of which is slidable on the fixed screw spindle 153 (figures 1 and 3). On the axis of wheel 150 is further freely rotatable the helical wheel 154 meshing with the endless screw 153 keyed to the shaft of the electric motor 156. It will be seen that when the wheel 154 is coupled to shaft 151 by means of the clutch wheel, motor 156 will drive the screw 153, while, for the other position of the clutch wheel, the wheel 154 is uncoupled from the shaft 151 and rotation of screw 153 is set up by the hand wheel.

The rotation of screw 153 is transformed into a displacement of the carriage perpendicularly to the screw by the two half-nuts 157, 158 (Figure 3) which may come to mesh with screw 153. The movement of the half-nuts 157, 158 towards or away from one another is obtained by the usual means of two pins 159, 159′ moving in two helical ramps and closing or opening the half nuts according to the direction of rotation of a gear 160. The rotation of gear 160 is set up by pinion 162 meshing with pinion 163 keyed to a shaft 164 carrying the hand actuated flap 165. It will further be seen that the actuation of hand wheel 165 causes the operation of the by-pass valve 166 so as to connect with one another the chambers 167 and 168 of the cylinder, and at the same time a closing of the half nuts 157, 158, with the result of equalising the pressure in the cylinder and consequently permitting the drive either by hand, through the hand wheel 150, or by the electric motor 156. If, on the contrary, the half nuts 157, 158 are opened by means of the hand wheel 160, the communication between chambers 167 and 168 will be closed and consequently conditions for hydraulic drive set up.

The parts will now be examined permitting the upward movement of the table 123. This upward movement is obtained either with the electric motor or by hand.

The frame supporting the table 123 may move with respect to the fixed support of the machine by means of a screw 216 (cf. in particular Figure 4) fixed in the support and engaged by a nut 215 integral in height with the table carrying frame and driven in rotation by the helical wheel 214 actuated by the endless screw 213 (Figure 3) keyed to shaft 200. This shaft 200 carries a number of stepped gears 195, 196, 197, 198 and 199 freely rotatable on the shaft but which may be coupled with it, each individually, by means of a key 201 arranged in a groove of shaft 200 and mounted at the end of a rod 202 sliding longitudinally inside the shaft 200 and integral with a grooved ring 203 driven by a fork 204 mounted on a lever 192 pivoted to the axis 205. This fork

is actuated by the bevel gear 206, 207, the rotation of the axis carrying the conical wheel 207 being determined by a selector lever (Figures 1 and 3) which may be set in a number of positions corresponding to various positions of key 201 and consequently to various speeds of shaft 200.

The gears 195, 196, 197, 198 and 199 are in mesh with gears 190, 191, 192, 193 and 194 keyed to shaft 187 rotating in the case 188 and on which are freely rotatable two helical wheels 181 and 183 meshing respectively with the endless screws 182 and 184. The endless screw 184 is integral with a gear 185 driven from wheel 186 integral with the endless screw 182. The screw 182 lastly, is driven by the electric motor 180 (Figure 1). It is clear that owing to this transmission, the two helical wheels 181 and 183 will rotate at different speeds. These wheels 181 and 183 may be alternately coupled to shaft 187 by the sliding key 186*a* integral with a ring 191′ driven by a fork mounted at the end of a lever, the angular displacement of which (Figure 4) is determined by the bevel gear 210, 211, the wheel 211 being driven by the selector lever 212 (Figures 3 and 4) which may be set into three different positions, two of which correspond to the two different speeds given to the shaft 187 by the wheels 181 and 183 respectively, and the third, or neutral position. corresponds to the nondrive of shaft 187 by motor 180.

The manual drive is set up (Figure 3) by a hand wheel 218 keyed to shaft 219 and a driving pinion 220 in mesh with the gear 221 which is in turn in mesh with gear 192. One will thus have either a hand drive, provided, of course, that key 201 couples the shaft 200 with the gear 197.

Grinder-device for the control of the machine-wear indicator

The grinder 56 (Figures 3, 6 and 7) is contained in a case 53 serving at the same time as a support for the wear indicator and for the device for control of the machine. The case 53 comprises a full extension 54 (Figures 6 and 7) fitting into a dovetailed groove 46*a* (Figure 3) of cage 45 of arm 46 for supporting the whole. On Figure 7, the spindle on which is engaged the grinder 56 is supposed to be ended by a cylindrical part 57 instead of a cone 37′ as in Figure 4. With this difference, the arrangements are exactly the same. The grinder 56 (Figure 7) is inserted between the flange 59 integral with the socket 58 coupled by a key to part 57 and flange 60 clamped by the spacing member 61 and nut 62. The whole is stopped (Figure 8) by nut 63.

The device for automatically stopping the grinder will now be described, assuming the grinder 56 to be in the position shown on Figures 3, 6 and 7. The grinder is adapted to cut grooves 232, 232′ (Figures 6 and 7) into the job 64 held, as already explained, on table 123 which, for this work, moves rapidly upwards.

According to the invention, a feeler 230 (Figure 6) is used, in contact with the bottom of the groove 232 and provided with a very hard lining 231 which thus remains tangent to the grinder periphery. The feeler 230, mounted with hard friction on shaft 234, normally forms one arm of a bent lever pivoted in 234 and the other arm of which carries a toothed sector 233 meshing with the gear 235 driving the rack 236 sliding in the groove 237. A part fixed to the rack 237 carries itself a small rack 238 meshing with pinion 239 which thus receives the angular displacements of feeler 230 (which are equal in amplitude to the wear of the grinder) and transmits them on one hand to the control device, and on the other to the wear indicator referred to as a whole as 240 and shown more in detail on Figure 7. It is seen that the axis 241 carrying pinion 239 also carries a gear 242 driving pinion 243 which, over wheel 244, drives pinion 245 cut in the socket 246 to which is keyed a needle 247, while another needle 248 is keyed directly to shaft 241. The needle 248 (see Figure 5) reads hundredths of millimetres inscribed on the dial 250, and needle 247 indicates full millimetres carried by dial 251. It is clear, without further explanations, that the displacements of needles 247 and 248 measure the amount by which the feeler 230 has pivoted about the axis 234 or, more exactly, the amount by which the working point of the grinder is being raised with increasing wear of the grinder, said rise comprising the upward motion of the job plus the wear of the grinder.

The control device will now be described, permitting to determine in advance the depth of the groove in order to stop the machine when the required depth is attained. A feeler 256 (Figure 6) rests against a bar 257, the upward movement of which is integral with that of the table 123. The toothed hub of this feeler drives the rack 259 sliding in a groove 260 and carrying along with it, in its upward and downward movements, the gear 260′ rolling on the rack 236 (driven, as explained, by the feeler 231). This gear 260′ is integral (Figure 9) with a shaft 262 which, over wheel 263 and gear 264, 265, drives the gear 266, 267 keyed to a full shaft 262′. The gear 267 drives, over the gear 268, 269, the needle carrying socket 270 engaged on shaft 262′. This socket carries, over an insulating ring 273, needle 272, while shaft 262′ carries, also over an insulating ring 275, the needle 274. These two needles (Figure 3), respectively indicating on a dial hundredths and full millimetres, are constantly connected electrically with one another by means of a spring blade 276 integral with the needle 274 and sliding over a conducting ring integral with the needle 272 (Figure 9).

The whole arrangement is enclosed in a case 277. In the case is also arranged a base plate 278 on which is mounted an insulating supporting disc 279, on the hub of which is freely rotatable a gear 280 carrying, on one side, an insulating ring 281 to which is fixed a conducting circle 282 in which is cut out a tongue 283 folded up and carrying a platinated contact piece 284 protruding over the dial (Figure 5) and with which may come into contact the needle 272. On a second insulating disc 287 is rotatable a gear 286 supporting, over an insulating ring 289, the conducting ring 290 in which is cut out the tongue 291 to which is riveted the platinum head contact piece 292 which may come into contact with the needle 274 (see also Figure 5). The scale division into hundredths of millimetres, seen in Figure 5, is carried by disc 287, while another disc 293 carries the full millimetre scale division.

The gears 280 and 288 may be rotated at will by means of the knobs 294, 295 (Figure 5) keyed to shafts 296 (Figure 10) carrying gears 297 in mesh with said toothed rings. Blades or brushes 298, 299 (Figures 9 and 11) slide on the conducting rings 282 and 290 insulated from the case 277 and connect these rings, over a wire 300, to the source of current, and, by a wire 301, to relays actuating electric distant control devices for reversing the current or stopping the machine.

It is clear that the rotations of gear 260′, depending both upon the displacements of feeler 230 (through the mesh of this wheel with the rack 236) and upon the movements of feeler 256 (by the rise of the shaft of this wheel under the action of the rack 259), give a measure of the depth of the groove cut by the grinder. It will therefore merely be necessary to bring, by means of the knobs 294, 295, the contacts 284 and 292 upon the scale divisions in full, tenths and hundredths of millimetres, corresponding to the required depth, for stopping the machine and, if necessary, lowering the table 123 at the required moment, due to the contacts successively set up between the needles 272, 274 and the corresponding contact parts.

Device for rounding off and correcting the grinders

The device adapted for rounding off the new grinders, i. e. giving them a first wear making them perfectly round, or for maintaining all the grinders at the same diameter when a number of them are working together, consists (Figure 6) in an auxiliary grinding wheel 300 pivoted on a shaft 301 fixed in a bracket 302 pivoted to the pin 303. The hub of the bracket carries a toothed sector 304 meshing with screw 305 driven by the knob 306. The spring 307 constantly urges the auxiliary grinding wheel in the direction of push so as to neutralize the various slacks. There is further provided (Figure 5) a dial 308 and a free needle 309 permitting the operator to determine the position to be given to the auxiliary grinder 300 at the moment it comes to act upon the grinder. The grinder 56 rotating at low speed, one will rotate slowly the knob 306 so that the screw 305, acting upon sector 304, applies the auxiliary grinder 300 against the periphery of grinder 56 which, by its rotation, carries the latter round with it. It will be seen that the drive only takes place upon contact, i. e. on the not round parts of the grinder. The pressure exerted by the auxiliary grinder 300 and its lines 310 will crush the support of the grinding particles and round off the grinder 56 or give its edge a required shape.

Periscope

The machine is fitted (Figures 5 and 7) with a periscope 320 provided with mirrors 321 and 322. The job 64, invisible inside its casings, may be followed, during work, in mirror 321 in which it forms an image. The job may also be illuminated by any suitable source of light.

Surfacing device

The machine may be fitted (Figure 12) with a multiple grinder 325 for effecting surfacing jobs by means of crossed lines. For this, the job 326 will be fixed on the table 123 which is set into a rapid to and fro motion according to the arrows 327 and 328, while the grinder carrier 329, driving the grinder over a bevel gear 331, moves according to the arrows 332 and 333. Other sorts of perpendicular drives may of course be used instead of the bevel gear. The machining obtained in this manner shows crossed or sinusoidal lines, the slope of which depends on the speeds of table 123 and slide 47 respectively to one another. This method permits to obtain very plane surfaces, since correction of the grinder itself will be effected over the whole surface of the job.

Operation

The operation of the machine will be described by way of example in the case where the grinder is mounted on the secondary spindle, in the position shown in Figure 3, and where it is desired to cut into the job 64 grooves 232, 232′ of a predetermined depth. The job is fixed to table 123. By means of the knobs 294 and 295, the operator sets the contacts 284 and 294 onto the desired scale divisions corresponding to the required depth of the grooves. Table 123 is then lifted by means of the hand wheel 218 until the job 64 reaches the grinder. The operator then lowers the feeler 256 mounted with hard friction on its axis, so that the needles 274 and 272 are in the zero position. He then places the bar 257 exactly in contact with the feeler 256, the bar being mounted on a not visible slide permitting to move it relatively to table 123 while coupling it to the table in vertical movement. The wear indicator has on the other hand been brought to zero by acting upon lever 311 (Figure 5), so that the rack 236 (Figure 6) strikes against the stop 312. By acting lastly on knob 313 (Figure 8), the rack 314 (Figure 6) is lifted, displacing the whole arrangement and bringing the feeler 230 tangent with the grinder.

The various motors are then started by actuating the contacts 316, 317, 318, 319 and 320 (Figure 2). The grinder 56 is set in rotation, slide 47 takes a rapid to and fro motion, while motor 180 lifts the table 123 with the speed required for scraping out work.

As the work goes on and the grinder consequently penetrates into the job 64, the feeler 230, gradually lifted by the bottom of the groove according to the wear of the grinder, actuates the needles of the wear indicator over the rack 236. At the same time, the bar 257 lifts the feeler 256 acting upon the rack 259. This motion is transmitted to the needles 272 and 274 over the rack 259 and wheel 260′, the angle of rotation of 260′ being decreased by an amount corresponding to the wear of the grinder due to the differential rolling of 260′ on the rack 236.

As soon as the needles 272 and 274 come in touch with the contacts 284 and 292, i. e. when the grooves have attained the required depth, the machine is stopped. It is then merely necessary to reset the various apparatus to zero for effecting a new operation.

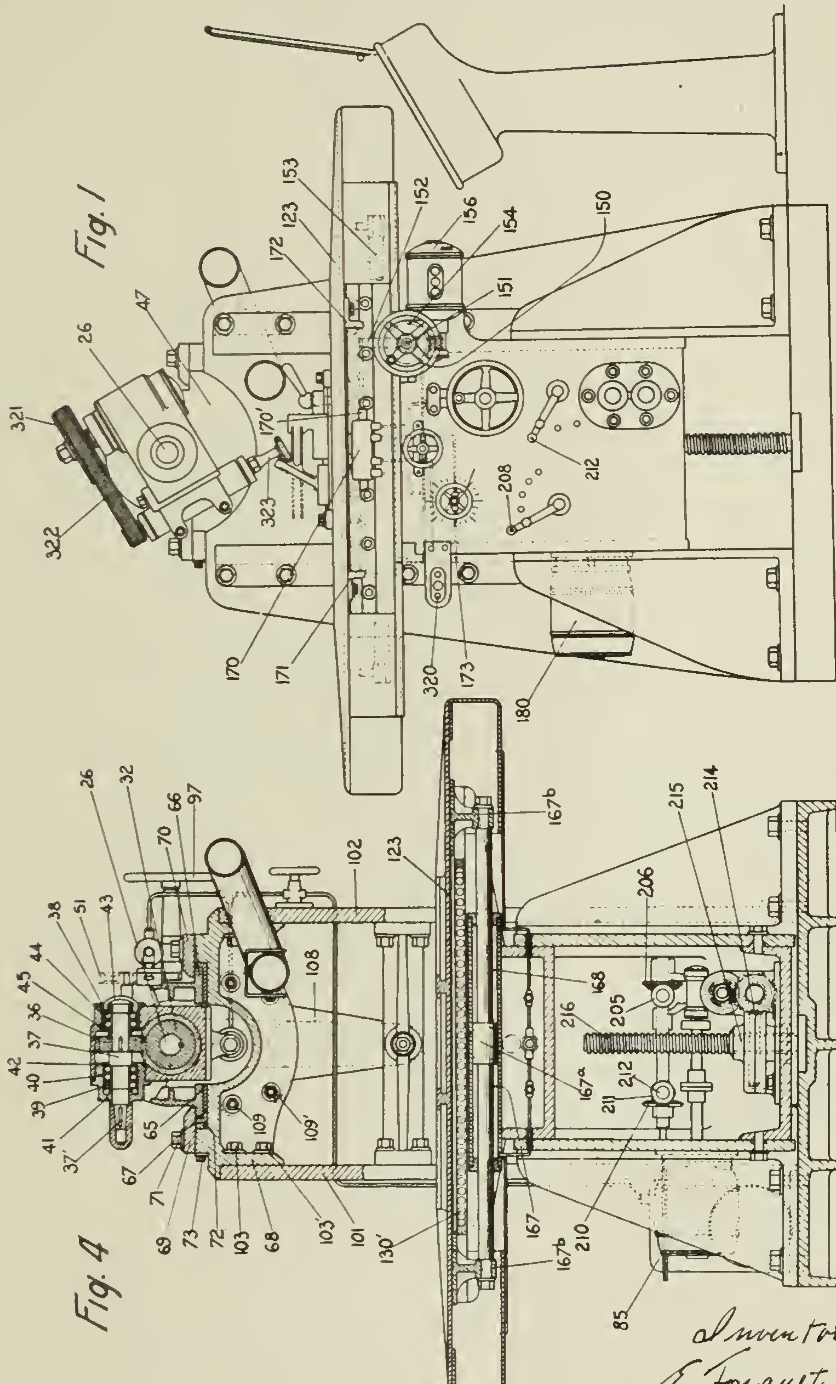
EUGÈNE FOUQUET.

[illegible]

PUBLISHED
JUNE 15, 1943.
BY A. P. C.

E. FOUQUET
GRINDING MACHINES
Filed Nov. 24, 1941

Serial No
420,313
6 Sheets-Sheet 1



Inventor.
E. Fouquet
By E. F. Wenderoth atty

PUBLISHED
JUNE 15, 1943.
BY A. P. C.

E. FOUQUET
GRINDING MACHINES
Filed Nov. 24, 1941

Serial No
420,313
6 Sheets-Sheet 2

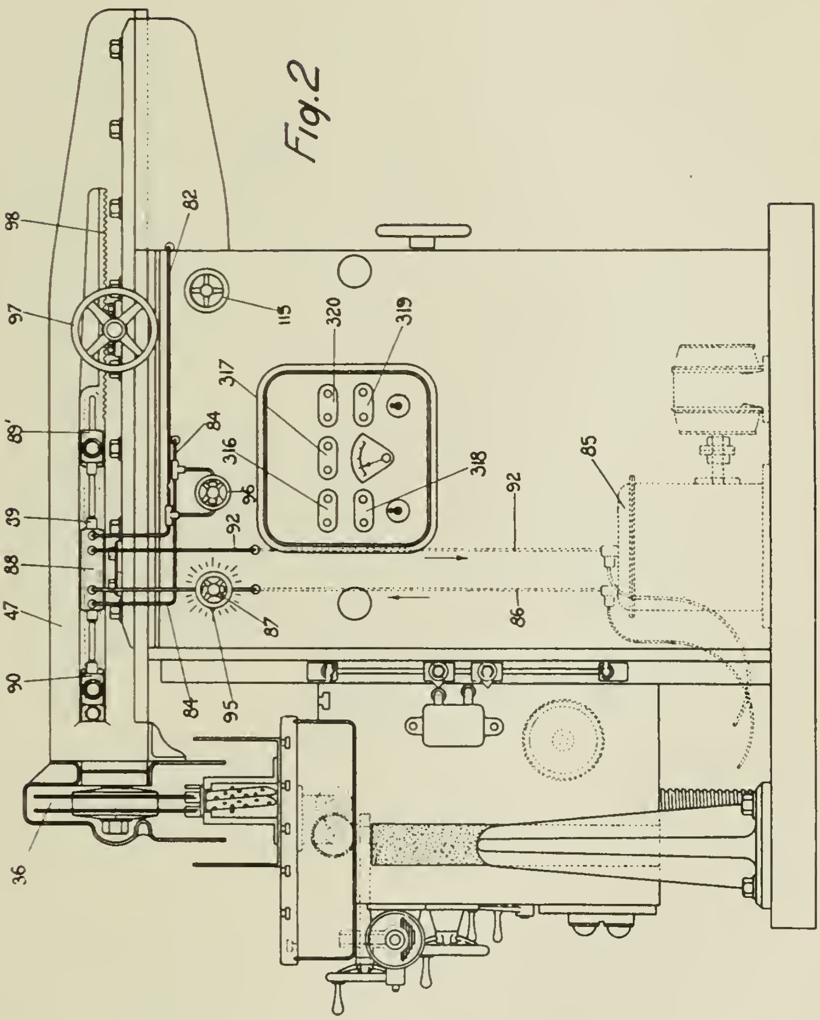


Fig. 2

Inventor:
E. Fouquet

By E. F. Wenderoth
Atty

PUBLISHED
JUNE 15, 1943.
BY A. P. C.

E. FOUQUET
GRINDING MACHINES
Filed Nov. 24, 1941

Serial No
420,313
6 Sheets-Sheet 3

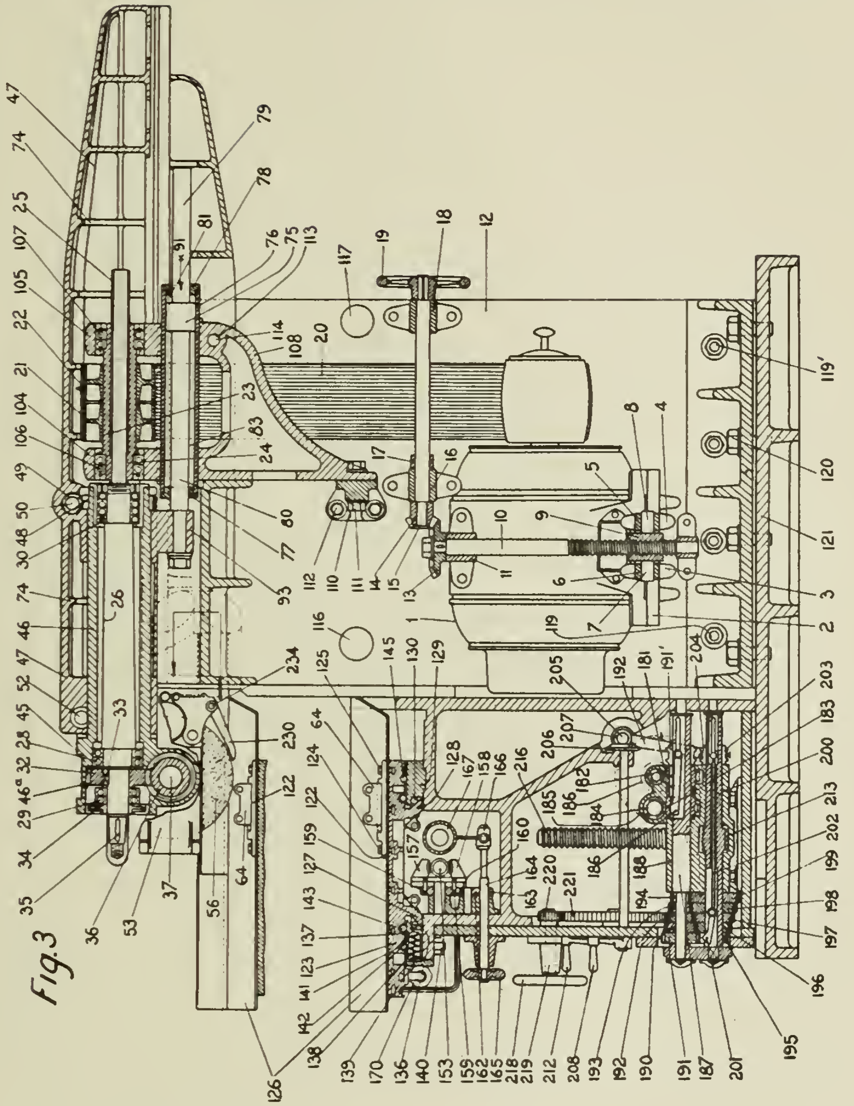


Fig.3

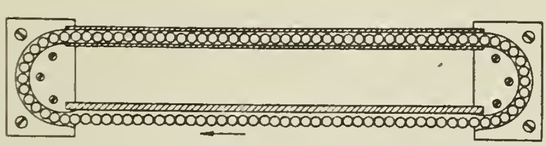


Fig. 13

Inventor:
E. Fouquet
By E. F. Wendaroth atty

PUBLISHED
JUNE 15, 1943.
BY A. P. C.

E. FOUQUET
GRINDING MACHINES
Filed Nov. 24, 1941

Serial No
420,313
6 Sheets-Sheet 4

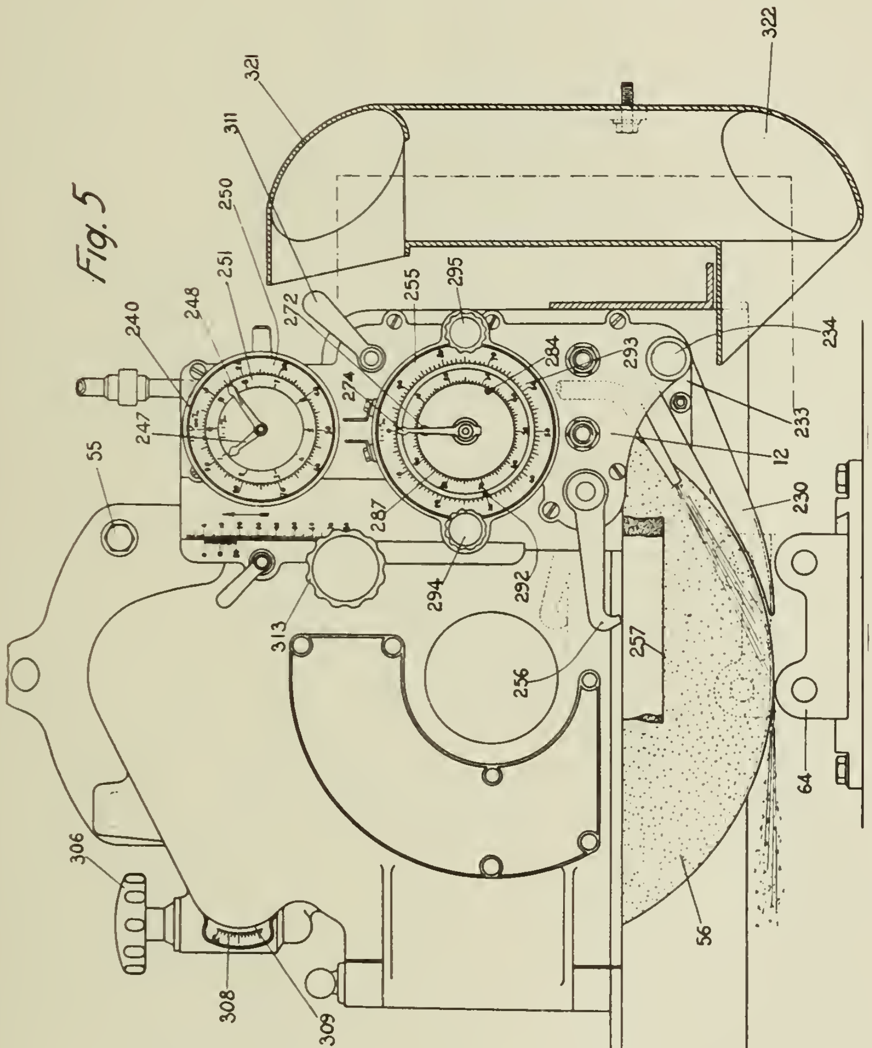


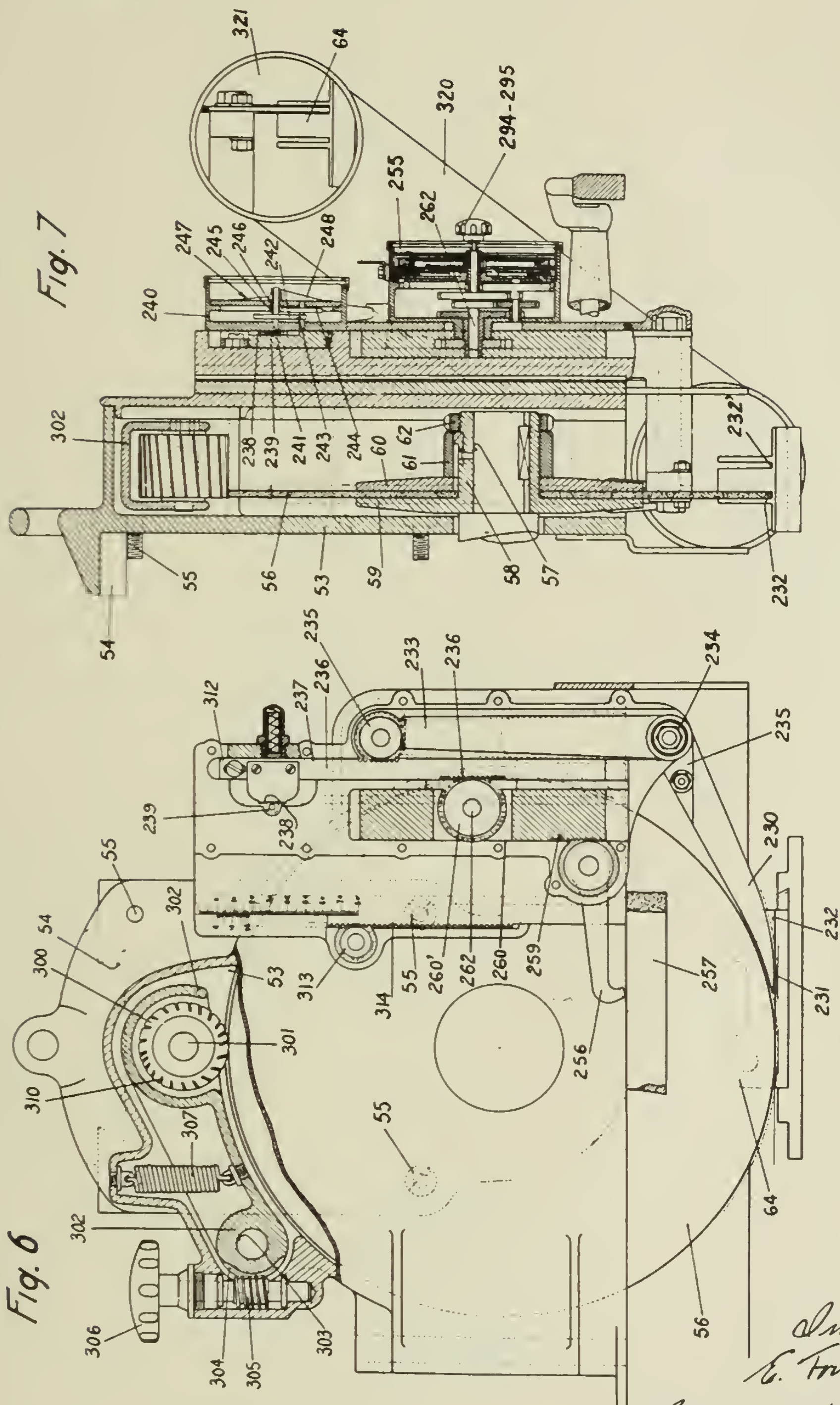
Fig. 5

Inventor:
E. Fouquet
By E. F. Wenderoth
Atty

PUBLISHED
JUNE 15, 1943.
BY A. P. C.

E. FOUQUET
GRINDING MACHINES
Filed Nov. 24, 1941

Serial No
420,313
6 Sheets-Sheet 5



Inventor:
E. Fouquet
By E. F. Wendroth
Atty

PUBLISHED	E. FOUQUET	Serial No
JUNE 15, 1943.	GRINDING MACHINES	420,313
BY A. P. C.	Filed Nov. 24, 1941	6 Sheets-Sheet 6

Fig. 8

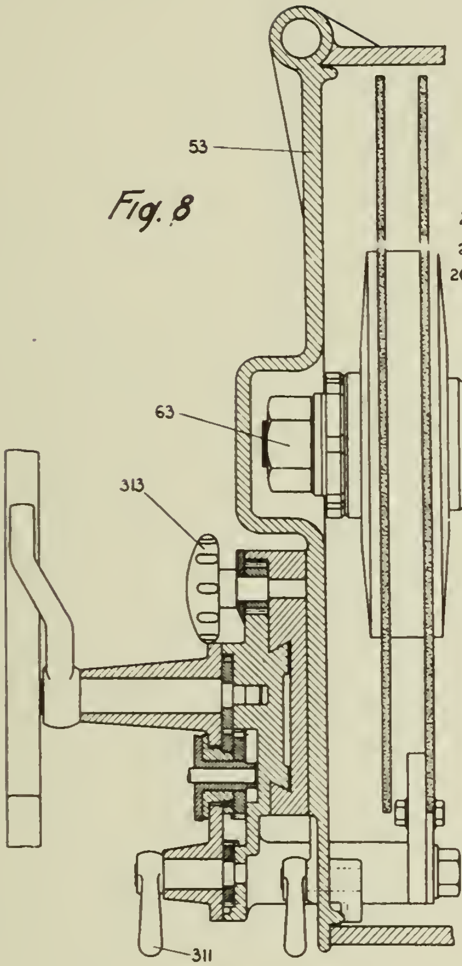


Fig. 9

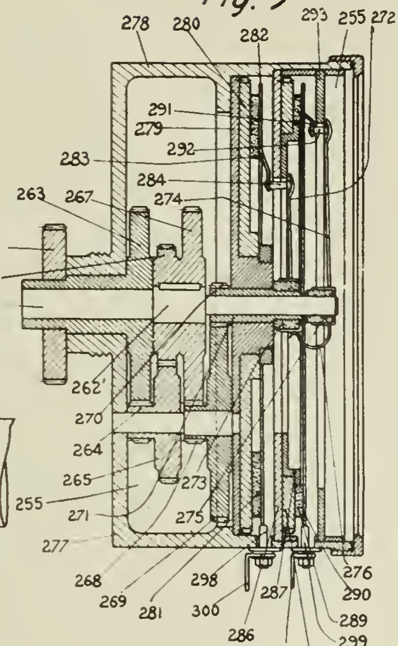


Fig. 11

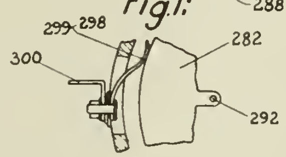


Fig. 10

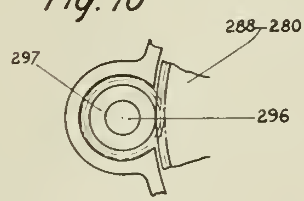
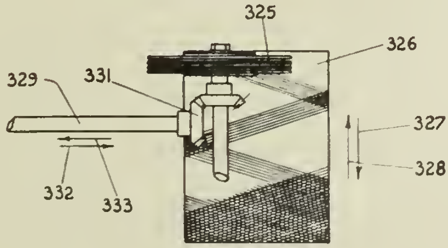


Fig. 12



Inventor:
E. Fouquet
By E. F. Wenderoth
Atty

Published June 15, 1943 Serial No. 421,996

ALIEN PROPERTY CUSTODIAN

APPARATUS FOR INTERRUPTING ALTERNATING CURRENT

Vítězslav Havlíček, Plzen, and Aleš Bláha, Prague, Bohemia and Moravia; vested in the Alien Property Custodian

Application filed December 6, 1941

This application is a continuation-in-part of our copending application Serial No. 198,970 filed March 30, 1938.

Circuit breakers for alternating current operate in such manner that some periods after starting the interruption the contacts are broken with the result that an arc is formed between the contacts. While these contacts are moving away from each other and traverse the distance to the circuit breaking position, the arc is cooled by injecting oil or gas. Shortly after reaching its striking distance the arc is extinguished, namely at the next following zero of the current at which the most favorable conditions for extinction of the arc are found. For driving such mechanisms there are employed at the present time almost exclusively, springs or compressed gas actuated by bolts valves or the like acted on by electromagnets which are most frequently operated by means of a relay.

Springs, compressed gas and the like possess properties which prevent the contact masses from being accelerated sufficiently in a short time. For example the striking distance for many normal line voltages (10 kv. to 100 kv.) cannot be produced during the time of a fraction of the period of a current of about 50 c/sec. For these reasons it was heretofore not possible to design a so-called synchronized switch, that is to say a switch in which the breaking of the contacts is set positively in the neighbourhood of the zero of an alternating current of about 50 c/sec. and the contacts of which would traverse the striking distance within a fraction of a period of the current to be interrupted, for ex. about 50 c/sec. or like.

The apparatus of the present invention is a so-called impulse synchronized mechanism which permits breaking the circuit under the conditions mentioned. This mechanism is designed on lines fundamentally different from the mechanisms of the switches hitherto in use. Above all, the contacts are actuated by an energy that is called impulse energy. This energy possesses the property of being on the one hand releasable in a sufficient quantity in a short time equal to a fraction of the cycle of the current to be interrupted, for example, during a time of 10^{-3} sec., and of being on the other hand capable of being set free in a fraction of the period of the current to be interrupted, for example in a time of 10^{-3} sec. By release is understood the rapid conversion of said energy, which is in the static condition, into dynamic energy. Setting free signifies the rapid preparation for the release of said energy. For example, if the conceptions are referred to a switch with springs, release is understood to be the length of time in which the static energy of the springs is converted into dynamic kinetic energy of the contacts, while setting free is to be understood to be the length of time during which the bolting is released in such a manner that the spring can begin to move. Setting free and releasing the springs takes about 10^{-2} sec.

Impulse energies make possible shorter setting free and releasing times. The energy of condensers may be used for example as impulse energy. The energy of a condenser may be impulse-like if the condenser is short-circuited across a spark gap. There occurs a discharge which may last for 10^{-5} sec. In a similar manner the energy of a condenser may be set free during a time equal to that in which the gap is perfored, that is to say in 10^{-7} to 10^{-6} second.

Condensors may accumulate economically several thousand joules, which are sufficient for the impulse acceleration of contact masses, for example, for breaking contacts weighing 1 kg. for a distance of several cm. during a time of 10^{-3} sec. The energy of the condensers may also be converted impulse-like into kinetic energy of the contacts. Conversion is understood to be the possibility of imparting the energy in a short time to the movable contact in the form of kinetic energy. The energy of condensers is converted into kinetic energy of the contacts impulse-like by causing the energy to flow through a coil with or without an iron core so that the current oscillates in this circuit and is damped aperiodically. Near said coil there is found another movable coil, which, for example is short-circuited. The magnetic field produced by the current in the stationary coil induces a current in the movable coil, and the movable coil is set in motion by the electrodynamic action between the coils. The movement is impulse-like, that is to say the coil may also travel several centimeters within a time of 10^{-3} sec.

The movable contact is connected to this coil in an appropriate manner. The connection may be established by means of a solid, liquid or gaseous insulation agent. The movable contact may be also formed by the coil itself. In this case it will be necessary to arrange the coil, compared with the first example, at comparatively larger distance to insure the insulating strength between the circuit to be interrupted and the rigid coil.

The impulse synchronized mechanisms of the present invention furthermore employ the prin-

ciple of the so-called contact division. This principle was employed for the following reasons:

It has been shown that with the employment of condensers the contacts of the usual switches can not be accelerated with the practically attainable forces to such an extent that they reach in a time of the order of magnitude or less than 10^{-3} sec., for example, in the time of the order of 10^{-4} sec., to spark the distance of the normal line voltages. This difficulty can be eliminated by selecting two or several contacts connected in parallel. These contacts possess the following properties:

a—They have by degrees, according to the order of magnitude, a smaller weight,

b—If the time of half-period of the current to be interrupted is taken into consideration, these contacts are broken successively at instants which gradually approach in order of magnitude after shorter spaces of time that zero in which the current is interrupted,

c—The individual contacts are fired successively by using ever increasing accelerations, with the result that they attain step by step greater velocities and pass the spark distance in a shorter time. The greater accelerations are obtained for example by employing condensers of the same capacity for the individual contacts.

Plate coils are suitable for the purposes as fixed and movable coils, for example, the movable contact may consist of a single conductive plate forming a short-circuited turn. The heavy contacts may be large heavy coils, and therefore, a wire with thick insulation. If a condenser for high voltage is used, it cannot be discharged directly into the fixed coils of the lighter contacts, as the latter are of small dimensions and the turns cannot be sufficiently insulated from another. Further, it is not possible to obtain with the coils which from a mechanical point of view can have only a small number of turns, a suitable number of periods for a good transmission of energy from the fixed to the movable coil. For this reason the invention inserts a transformer between the condenser and the fixed coil. The transformer is with or without iron, designed only for impulse charge.

The discharges of the condensers must be synchronized with great accuracy wth relation to the course of the current to be interrupted. This is accomplished by using an impulse relay. The impulse relay catches on the one hand the formation of the short-circuit and on the other hand, with great accuracy, the current zero. The first part relay, the so-called overload relay, which catches the formation of the short-circuit (or the start of the interruption) performs this start in 10^{-3} sec. It is designed as an overload relay, but in such a manner that the masses of the relay are small. It is this relay which sets free the heavy contact. The other part relay determining zero, the so-called current relay, determines this zero with a greater accuracy as to order of magnitude (i. e. in shorter time as to order of magnitude) than the time of the mechanical interruption of the particular contact controlled by it. If we take, for example, a relay which sets free a contact the mechanical setting free of which takes 10^{-3} sec., the relay determines the zero with an accuracy of 10^{-4} sec.; if a contact is set free the mechanical setting free is 10^{-4} sec. the relay determines the zero with an accuracy of 10^{-5} sec.

Such zero current relays according to the invention are based on the electronic or another principle. A so-called impulse-divider is used with them, which supplies a voltage proportional to the current to be interrupted (maximum 200–300 volts). The impulse divided may be produced, for example, by inserting a small resistance in the circuit of the current to be interrupted. The voltage at the terminals of this resistance is transformed for the relay by means of a transformer with a large number of turns on the primary and secondary side. Further, this voltage is rectified, so that sudden changes of voltage occur near the zeros of the rectified voltage. When suitable electronic valves are selected, said changes can further be made use of in such a manner that at the outlet of one of them there appear triangular impulses produced by the cutting out of sudden drops of the rectified voltage. By reinforcing these impulses and suitably limiting them the current zero may also be determined with an accuracy of 10^{-5} sec.

In order to insure that the contact in question is broken at the proper instant, it is necessary to shift the moment of starting by an appropriate space of time toward the zero of the current to be interrupted. This is effected by shifting the moment of the determination of zero in such a manner that a compensation is inserted in the impulse divider. Said compensation is obtained by another part being connected to the voltage taken from the resistance which represents a component in phase with the current, which part is taken from a small inductance and represents a component displaced by ninety electrical degrees with respect to the current, the voltage being thereby displaced on the secondary side and thus also the determined current zero.

The impulses of the zero current relay amount to only some hundreds of volts. They are strengthened for the purpose of being able to actuate the condenser of the contacts. This is accomplished by causing them to act on the grid of a thyratron, whereby the condenser charged with 500 v. is short-circuited. The short-circuit current from the condenser flows through a few turns of a transformer the secondary winding of which has a great many turns, with the result that a high voltage impulse of about 30 to 40 kv. appears on the secondary side. The steepness of the first impulse amplitude is so great that a sufficiently accurate release of the contact is obtained. The transformer is chosen accordingly. The impulse is led from the transfomer by way of a suitable resistance (30,000Ω) to the middle electrode for three-electrode spark gap. To the outer electrodes there are connected the condenser and the stationary coil, or the condenser and the primary winding of the transformer of the stationary coil, in series. The overload relay and the zero current relays are coupled to each other, the whole thus being actuated only when the starting of the interruption sets in.

On the annexed drawing there is represented an example of the apparatus accordingly to the invention. Fig. 1 shows a diagrammatic view of the current level during one period of an asymmetrical short-circuit in case of an interruption with two parallelly connected partial contacts in one phasis; Fig. 2 an example of the connection scheme of the apparatus with two partial contacts and Fig. 3 a constructional example of the apparatus with two partial contacts.

In Fig. 1 the heaviest contact is broken at the instant I, so that the time IA is nearly a half-period, i. e. about 10^{-2} sec. The following lighter

contact coming next is broken at the instant 2, so that $2A = 10^{-3}$ sec.

This arrangement produces the following interruption: The heavy contact transmits the current continuously, but does not cut it out. At the instant 1' it transmits it to the light contact. In this instant 2 this light contact is fixed off and interrupts the residual small current 2'A. Thereby the result may be obtained that the contact which really interrupts the current can be light (some grams) and is charged only with a current that is smaller as to order of magnitude than the short-circuit current, and that in a time of 10^{-3} sec. or less.

In Figure 2 TU is the rectifier apparatus fed from an auxiliary source. R_1R_2 are charging resistances. C_1C_2 high tension condensers where the impulse energy is being accumulated. I_1I_2 are the corresponding spark gaps for its setting free. D_1D_2 are fixed coils through which flows in impulse manner the energy from the condensers and where they are released. For a heavy interrupting contact K_1 there is provided the movable coil E_1 whereas for the lighter contact K_2 a movable coil E_2 is foreseen. The central electrodes of the corresponding spark distances are influenced by the voltage impulse of the transformers T_1' and T_2' through the resistances R_1' and R_2'. ÜR is a high speed overload relay being fed from the current transformer T_1''. NR' is a zero-current relay fed from a current transformer T_2''. Contacts K_1' short-circuit the condenser C_1', the thyratron L_2 discharge the condenser C_2' as soon as its grid receives a positive impulse. The condensers C_1' and C_2' are charged from an auxiliary source not shown in the drawing.

In the constructional example according to Fig. 3, K are the main contacts, K_1 and K_2 the parallely connected movable contacts. S is an insulating rod connecting the contact K_1 with the coil E_1. G is compressed gas, I the insulation, D_1 and D_2 are the fixed coils.

The apparatus shown works in the following manner:

As soon as there occurs any short-circuit in the network, the high speed overload relay ÜR produces a discharge of the condenser C_1' so as to produce in the moment 1 on the central electrodes of the spark distance a high voltage impulse so as to cause a discharge of the condenser C_1 through the coil D_1. In the circuit C_1D_1 there are oscillations of the discharge current and it induces a synchronous current of the opposite polarity in the coil E_1. The relative electrodynamical effects of both these currents cause the coil E_1 and the contact K_1 connected therewith to move. Before the next passage of the current through zero there is produced an impulse in the zero current relay which takes place in the moment 2, laying in an appropriate time interval before the real zero of the current. In this manner is sent a positive voltage impulse to the grid of the thyratron L_2, so that a discharge of the condenser C_2' takes place. The high-voltage impulse produced in this way causes a spark in the gap 2 and effects the discharging of the condenser C_2 in the coil D_2. The oscillation current causes, in the same way as described above, a repulse of the movable coil E_2. The same compresses the medium (gas) G, so that the contact K_2 is put into a high speed movement (100m/sec.) quite before the current that shall be interrupted passes its zero.

A re-connecting takes place so that the contacts are brought to their original position in a convenient manner.

VÍTĚZSLAV HAVLÍČEK.
ALEŠ BLÁHA.

PUBLISHED | V. HAVLICEK ET AL | Serial No.
JUNE 15, 1943. | APPARATUS FOR INTERRUPTING ALTERNATING CURRENT | 421,996
BY A. P. C. | Filed Dec. 6, 1941

Fig. 1

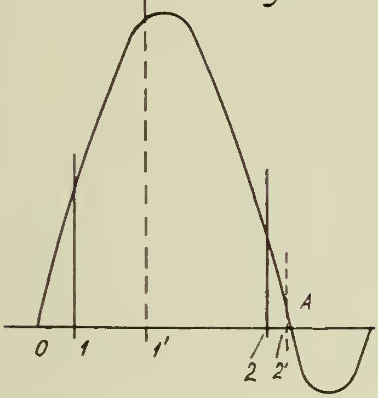
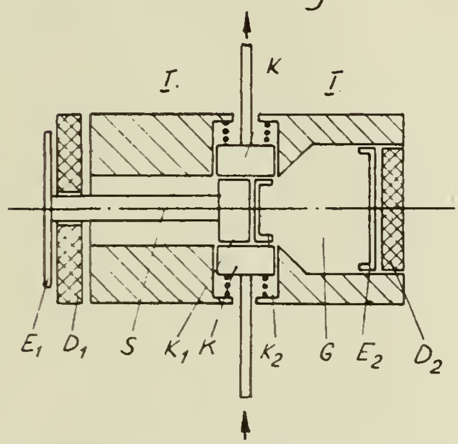


Fig. 3



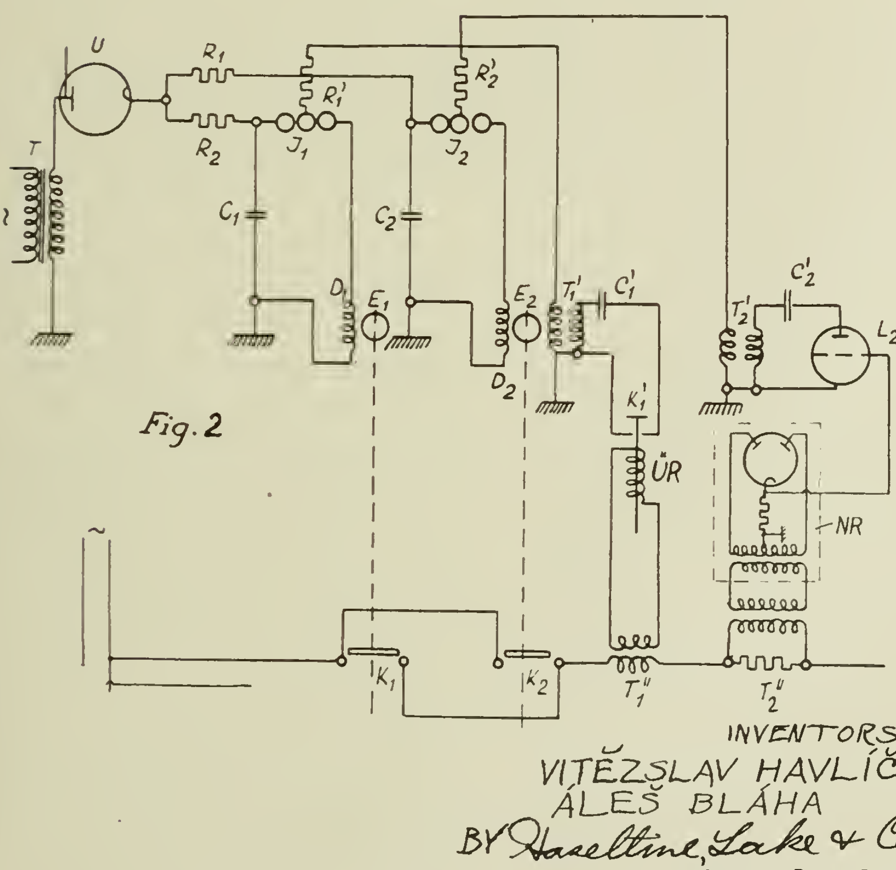


Fig. 2

INVENTORS:
VITĚZSLAV HAVLÍČEK
ÁLEŠ BLÁHA
BY Haseltine, Lake & Co
ATTORNEYS.

Published June 15, 1943

Serial No. 422,459

ALIEN PROPERTY CUSTODIAN

AGGLOMERATING MIXTURES OF SOLID MATERIAL AND LIQUID

Georges Passelecq, Paris, France; vested in the Alien Property Custodian

No Drawing. Application filed December 10, 1941

A method is known by which it is possible to increase the compactness and, therefore, the tensile strength and/or the resistance to compression of certain agglomerated bodies, which consists in submitting the mixture of the substances which must finally form the agglomerated body to a vibratory action of the order, for instance, of 3,000 to 6,000 vibrations per minute. This vibratory action is transmitted to the said mixture before the agglomeration is achieved or even before it is practically started. Generally the vibratory action gives better results when the vibratory movement has a direction which is parallel to the direction of the force which would tend to shift the said substances if the latter were free in the space. This vibratory action is imparted to the substance or substances to be treated by means of vibrating devices such as, for instance, electrical devices which are unbalanced or provided with excentrical means and which are secured to the vessel containing the said substance or substances or, still better, by placing the said vessel on a vibrating table.

Thus, for instance, by causing vibrations to act in a vertical direction on a mixture of pebbles, sand, cement and water, adapted to form a concrete after binding, one succeeds in doubling the mechanical resistance of the said concrete. The vibrations which are imparted to the mass of the mixture are transmitted to the substances which form the latter and cause them to slide against each other so that water rises to the surface and so the pebbles and the sand corns take a directional position and slide against each other so as to diminish the volume of the spaces comprised between them and to remove the air contained therein, the said spaces being more completely filled with cement and water than if no vibratory action were imparted to the mixture. In spite of the remarkable results obtained by the said method it would still be desirable in most cases of the practice to increase the resistance of concrete.

In a like manner, in the manufacture of artificial teeth from porcelain powder which is then submitted to a burning operation resulting in a more or less complete fusion, the use of a vibratory action has for its effect to insure a mutual granular arrangement of the corns of the mixture of porcelain powder and water which is used, the spaces between the corns being then less numerous and smaller than if no vibratory action had been imparted to the mass.

It is also known how difficult and expensive it is to agglomerate or even only to dry solid material in a colloidal state in a liquid excipient or vehicle. This is the case, for instance, for peat and also for the sludge or slamms encountered as waste of manufacturing operations in considerable quantities which the economical conditions do not permit to agglomerate with advantage. If it were possible, through a simple and unexpensive method, to free the said materials from an important portion of the water they contain the agglomeration of the same would be greatly facilitated and this would more particularly increase the value of the said materials. Now, in the case of peat freshly extracted from the moors and containing, as well inside as outside the cells which form the same, a proportion of water which can reach a total amount of 90% of the weight of its global mass, the use of powerful hydraulic presses and of certain filtering devices allows at the best to reduce this proportion to 50% the water of the cells being not expelled. Nor does the imparting of a vibratory action to the said materials permit to lead by itself to the desired result.

In the like manner, the agglomeration of still other materials which are mixed with a liquid or a liquid solution in order to obtain a mouldable or slubbable paste would be rendered more advantageous and the obtained products would be of a better quality if the proportion of liquid or solution as, for instance, water or a solution of sodium silicate, or dextrin, molasse, a product of the hydrolysis of cellulosic material, gum, sugar, protein, glue, natural or synthetic rosin which is used for forming the paste to be moulded or slubbed were diminished and, simultaneously, if the mutual granular ararngement of the grains to be agglomerated were facilitated during the operation of imparting a vibratory action to the same.

The present invention has for its object a method which permits of obtaining this result in all the cases where it is desired to form an agglomerate body, while imparting a vibratory action, with a solid material in the form of grains, even if the latter are mixed with water in the form of a dispersion or an emulsion or even if they are totally or partially in a colloidal state, as this is the case, for instance for peat, sludge, residue of wine manufacture, of sugar-mills or sucrate-works.

The process according to the invention facilitates the agglomeration of the material of the above defined kind and permits to obtain agglomerated bodies which are more compact, more dense, less porous and have an increased me-

chanical resistance for the same power of the agglomerating devices. It offers the possibility of reducing the proportion of water which is used and, consequently, the volume of the mixing devices, the weight of the substances to be conveyed to the moulding devices, the space occupied by the latter and their power for the same final density of the agglomerated bodies. In the case of material in the state of colloidal suspension as, for instance, peat, the said method insures the evacuation of a large proportion not only of the water serving as an excipient, but also of the water contained in the cells themselves. In every case, it permits of reducing the period of time for imparting the vibratory action necessary for obtaining the same granular arrangement of the treated material or materials as when the process is not applied to, or for the same duration of the vibration, of meliorating the said granular arrangement with all the advantages resulting therefrom.

The said process essentially consists in incorporating a wetting and dispersing agent with the mass which it is desired to agglomerate or simply to dry—and which comprises the material to be agglomerated or dried, a liquid, a solution or an emulsion and eventually one or more binding agents. The proportion of wetting and dispersing agent which is to be added to the mass and mixed therewith may be different from one kind of mass to the other but it should be in any case sufficiently large in order that the granular arrangement assumes, under the action of the vibration, an improved structure according to which the mean distance between the centres of gravity or of shape of the grains of solid material to be agglomerated or dried is diminished, which results in increasing the proportion of liquid, for instance of water, which is expelled from the mixture by the vibratory action imparted thereto.

The proportion of wetting and dispersing agent which is used for obtaining this result cannot be fixed, in a general manner, by any law. Preliminary experiences are to be made in every particular case for determining the proportion which gives the result. When starting from a proportion which is equal to traces of wetting and dispersing agent and progressively increasing this proportion, it is to be noted that for each case of use of the same vibratory action the improvement of the granular arrangement generally increases, but that the improvement becomes a constant one from a certain proportion. Therefore, there will be no advantage in exceeding this proportion, since the best result has already been obtained by using it. An adjunction of wetting and dispersing agent corresponding to 0,05–0,25% by weight of the pulverulent material to be agglomerated will generally be convenient for obtaining a good result.

The wetting and dispersing agents which are suitable for carrying the process into practice are those which do not combine with the substances and chemical compounds in presence, in such a manner that combinations are formed which would destroy the said wetting and dispersing agents and substantially diminish their action. Preliminary tests permit of determining whether any known wetting and dispersing agent can be adopted in the case of a given mixture or must be discarded. In a general manner the wetting and dispersing agents used in the textile industry are well suitable for carrying the process into practice. For instance, derivatives will be used, which are obtained by sulphonation of fatty bodies, fatty acids, fatty alcohols, derivatives of the fatty acids such as the esters or amides of these acids. Wetting and dispersing agents can be used which are found on the market and which are based on products obtained through condensation and sulphonation of aromatic hydrocarbons with one or more aldehydes, or also products of the same kind obtained from derivatives of the said hydrocarbons or in the like manner, products obtained by causing a body which is not soluble in water and contains active hydrogen to act on ethylene oxide, by choosing the compounds of this class which are soluble in water, as well as compounds obtained by sulphonation of the residues which are left when distilling benzoic aldehyde.

Another kind of products which are also suitable for carrying out the process are products of vegetable origin which possess a wetting property when dissolved in water, such as for instance, saponin, licorice or lyes left by the treatment of cellulosic materials with sulphites or bisulphites.

The vibrating action which is used for carrying out the process according to the invention can be of the order of the action which is normally used in the manufacture of agglomerated bodies through vibration as, for instance, 5,000 to 6,000 vibrations per minute or even higher.

When applying the hereabove specified process it is possible to lower by 40% and even more the proportion of water contained in a rich mixture adapted for forming a concrete and at the same time to increase the mechanical resistance of the concrete, by using a proportion of wetting and dispersing agent of 2 to 4‰ (two to four per thousand) with respect to the weight of the water.

The following are non limitative examples of carrying the invention into practice.

Example 1

When starting according to usual technics from a rich mixture showing the following composition:

	Cubic metres
Fine gravel	0,800
River sand	0,400

Portland cement of first quality 400 kgs. one obtains after vibration has occurred, a concrete possessing when set a resistance to compression of 350 kgs. per square centimetre.

If according to the invention, 150 grams of a wetting and dispersing agent such as the sodium salt of a sulphonated concentration compound of naphthalene with formol and a quantity of water lowered to 50 litres are caused to be mixed with the same quantity of solid materials as hereabove recited one obtains after they have been subjected to a vibratory action as hereinbefore specified a concrete having after setting a resistance to compression higher than 700 kgs per square centimetre. Furthermore, the porosity of such a concrete is three times less than the porosity of the foregoing concrete.

Example 2

When agglomerating slamms obtained from the washing of coal and containing 25 to 30% of water, a vibrating action applied to the material to which have been added a wetting and dispersing agent in the proportion of 0.5 to 0,1% of the weight of the water to be expelled leaves a mass which no longer contains more than 5 to 6% of water. By then adding 3 to 5% of cement

with respect to the weight of the so concentrated slamms very resistant briquettes are obtained.

Example 3

To a cubic metre of peat at 80% of water containing 200 kgs of dry material, 400 grams of the wetting and dispersing agent specified in the Example 1 here above are added, being dissolved in water left by a precedent water extraction operation. The mass so added is allowed to soak, then it is vibrated during 70 to 140 seconds according to the colloidal power of the peat, care being taken, according to technics already known per se, that a free metal sheet the shape of which corresponds to the inner contour of the vessel which contains the peat, is placed on the upper surface of the wet peat. Water is expelled from the mass. A peat-cake of 240 to 280 kgs is removed which no longer contains more than 20 to 25% of water. The water left by the extracting operation is conveyed to the mixing machines or to temporary peat stockage vats in view of sparing the wetting and dispersing agent which has been used.

Example 4

By incorporating to flotation coals coming out of the washing room, a wetting and dispersing agent such as that which is quoted in Example 1 hereabove, in the proportion of 0,005% of the weight of the water to be expelled, the water content of the said coals is lowered to 2 to 4% because of the vibrating action.

Similar results are obtained when treating metallic ores in a like manner.

GEORGES PASSELECQ.

Published June 15, 1943 Serial No. 428,794

ALIEN PROPERTY CUSTODIAN

PROCESS FOR THE MANUFACTURE OF METALLIC GLUCINUM AND OF ITS ALLOYS

Robert André Gadeau, Saint Jean De-Maurienne France; vested in the Alien Property Custodian

No Drawing. Application filed January 29, 1942

A certain number of alcaline fluoglucinates, such as $NaF.GlF_2$ and $2NaF.GlF_2$, $KF.GlF_2$ and $2KF.GlF_2$, $2NH_4F.GlF_2$, $2LiF.GlF_2$, are already known, but nobody has ever mentioned a calcium fluoglucinate. On the other hand, the existence of the latter could not be foreseen, because aluminium and magnesium, which chemically come closest to glucinum, yield fluorinated alcaline compounds (such as cryolithe: $3NaF.AlF_3$, potassium cryolithe: $3KF.AlF_3$, the double fluoride $NaF.MgF_2$), but neither of them gives a fluorinated calcium compound.

I have found, and this is the object of the present invention, a definite fluorinated glucinum and calcium compound, constituting the calcium fluoglucinate, with the formula $CaF_2.GlF_2$ or $CaGlF_4$. This is a well-defined composite salt, since the fluoglucinate $CaGlF_4$ is practically insoluble in water, while the glucinum fluoride GlF_2 is very soluble in the latter. On the other hand, the melting point of calcium fluoglucinate corresponds to a maximum of melting diagram CaF_2 versus GlF_2. Lastly, the specific weight of calcium fluoglucinate, which is 2.9 at 20° C., marks an important contraction upon the specific weight corresponding to a simple mixture of both these fluorides.

The fluoglucinate $CaF_2.GlF_2$ is easily obtained by melting a mixture in suitable proportions of glucinum fluoride and calcium fluoride, or a mixture in suitable proportions of glucinum and ammonium fluoride with calcium fluoride.

For its industrial preparation, sodium fluoglucinate $2NaF.GlF_2$ can be melted together with the corresponding amount of calcium chloride, in a manner to set up the reaction:

$$2NaF.GlF_2+CaCl_2=GlF_2.CaF_2+2NaCl$$

The reaction product is washed out with water for eliminating the residual sodium chloride.

Industrially, the same reaction is carried out in water, by precipitating a solution of $2NaF.GlF_2$ with the exactly required amount of a calcium chloride solution.

The required amount of hydrofluoric acid can also be reacted upon calcium glucinate $CaO.GlO$, which is easily obtainable by precipitating with lime various soluble industrial glucinum salts.

These methods of manufacture are not limitatives; since the present invention concerns the calcium fluoglucinate as a new industrial product, all the classical chemical processes may be set up for its preparation.

The invention further concerns the various industrial applications of the new product: $CaF_2.GlF_2$.

It is known to prepare glucinum alloys with metals which are less electropositive than glucinum, by reduction of reductible glucinum compounds by means of an alloy of the latter metals with magnesium. The use of the fluoglucinate $CaF_2.GlF_2$, object of the present invention, as reducible compound, permits an economy owing to the fact that the $CaF_2.GlF_2$ yields all its glucinum by reduction with a heavy magnesium alloy, whereas it is known, from the German Patent 675,526 of May 1934, that the sodium fluoglucinate, solely used up to the present as reducible compound, will only yield half of its glucinum content under the same reducing conditions, thus necessitating a rather costly operation for the recuperation of the glucinum in the residual baths.

It is thus possible to use industrially the calcium fluoglucinate $CaF_2.GlF_2$ for the preparation of glucinum alloys, for instance with copper, aluminium and zinc. In the case of the zinc alloy, it may be useful to lower the melting point of the fluoglucinate by adding a flux, as for instance $CaCl_2$ or $MgCl_2$, in a manner to set up the reaction well below the boiling point of zinc.

A method for preparing pure glucinum is known, consisting in heating a zinc-glucinum alloy above 1,280° C. in order to distill the zinc and melt the glucinum. In this process of manufacture, an important economy is obtained, in the first preparation phase, starting from the zinc-glucinum alloy prepared by using the calcium fluoglucinate $CaF_2.GlF_2$ as a reducible compound of glucinum.

The same economy is also provided, in the manufacture of alloys of glucinum and of non-volatile metals, when the calcium fluoglucinate is used as reducible compound for obtaining the zinc alloy serving as a base (alloy of glucinum, zinc and non-volatile metals) by reduction of said calcium fluoglucinate by means of an alloy of magnesium, zinc and non-volatile metals which are to be alloyed to the glucinum,—said base alloy being subsequently heated to a temperature sufficient for distilling the zinc (above 1280° C.) and agglomerating, by melting, the residual alloy.

In the various reduction methods recalled above and which are by no means limitative, it is always feasible to add to the calcium fluoglucinate an excess of calcium fluoride, as well as suitable fluorinated or chlorinated fluxes.

ROBERT ANDRÉ GADEAU.

Published June 15, 1943

Serial No. 427,480

ALIEN PROPERTY CUSTODIAN

CHARGING APPARATUS FOR NETWORK CONNECTION, FOR ACCUMULATOR POCKET LAMPS

Ewald Zdansky, Berlin, Germany; vested in the Alien Property Custodian

Application filed January 20, 1942

The present invention relates to a charging apparatus designed to enable pocket lamps with built-in accumulator in which the charging contacts are led outside the electrolyte tank according to the known method and the insulating lamp casing is best made to serve directly as accumulator electrolyte tank so that the charging contacts previously mentioned shall be accessible without having to dismantle the lamp—to be charged with absolute safety from the light network without requiring a transformer to be inserted between the light network and the charging circuit of the pocket lamp.

To attain the absolute safety aimed at it is not sufficient to protect against contact during the charging operation the connecting contacts of the charging apparatus and the charging contacts of the pocket lamp. On the contrary, practice has shown that to attain absolute safety the whole accumulator electrolyte tank as well must be protected against any contact possibility. In fact, should this electrolyte tank—which is mostly made of artificial resin or similar materials—present hair cracks or fissures as a consequence of rough or faulty handling, outward diffusion of the electrolyte is likely to take place, more particularly with alkaline or "Edison" accumulators. In this case a conducting layer may form on the surface of the electrolyte tank and through the electrolyte a connection be established with the network, thus making contact with this surface dangerous already before the damage to the electrolyte tank becomes at all visible on the outside or can be otherwise noticed by others than experts.

According to the present invention and taking into account the facts recorded above an absolutely contact-safe arrangement has been attained by using a cup-shaped insulating shaft socket carried in the casing containing the switch components of the apparatus for network connection. This socket surrounds the pocket lamp slipped into it, leaving a small clearance, and carries the connecting contacts of the apparatus for network connection sunk to such an extent in lateral slots that these connecting contacts only get into contact with the charging contacts of the lamp as and when the whole electrolyte tank of the latter is already surrounded by the cup-shaped shaft socket previously mentioned, and consequently contact-proof.

The invention shall be more particularly described below, with the assistance of two constructional examples. Enclosed is a drawing in which:

Fig. 1 and Fig. 2 represent two diagrams of connections for pocket lamp-charging appliances, merely to show the task set himself by the inventor. In these diagrams the terminal contacts of the charging apparatus are directly connected with the network over the charging rectifier, thus making perfect contact safety for the pocket lamp to be connected an essential requirement.

Figs. 3 and 4 show schematically two constructional examples of arrangements according to the invention.

In Fig. 1 both plug pins 1 of an intermediate plug to be connected with the network are connected on the one hand with the plug bushes 2 and on the other hand with one another over a potential divider 3, 4. The charging potential for the accumulator 5 of the pocket lamp 6 is taken out at resistance 4 and led to the connecting poles 8, 9 of the charging apparatus 10 over a rectifier 7. Any current consumer, for instance a table or standard lamp may be connected with the plug bushes 2. When using such a charging switch arrangement it is obvious that not only contact with any part of the line may bring about an earth connection, but also that contact with the outer body of the pocket lamp 6 itself may establish earth connection in case the accumulator electrolyte tank should present any cracks through which traces of the electrolyte might get outside and result in a surface leakage current to the electrolyte.

The same remark applies to the charging switch arrangement shown in Fig. 2, which may be equally used for continuous and alternating current, and in which between the connecting plug 1 and the accumulator 5 of the pocket lamp there is only one rectifier glow discharge tube 11 and a current limiter resistance 12 within the appliance 10*a* connecting with the network.

Any such possibility of earth connection is, however, completely eliminated when equipping the charging apparatus—say according to Fig. 3 or to Fig. 4—with an insulating cup according to the invention and made to fit the outline of the pocket lamp.

According to Fig. 3 the network connecting appliance consists of an insulating body 13 directly carried by the contacts 14 and made to contain the switch components inscribed in a rectangle 10 (Fig. 1) or 10*a* (Fig. 2). This insulating body carries at the bottom the plug bushes 15 and 16—which are not interchangeable—located contact-proof. Below the insulating body 13 there is suspended according to the invention the insulat-

ing cup 17 completely encasing the pocket lamp 18 and provided with grooves 19 and 20 which are not interchangeable. Into these grooves are sunk the connecting poles 21 and 22 which come into contact with the charging contacts 23 and 24 of the pocket lamp 18 when the latter is inserted, and are connected as well with the contact pins 25 and 26, which latter when in use are in mesh with the plug bushes 15, 16.

By selecting a convenient size for the insulating cup 17 there is no difficulty in making it impossible for the pocket lamp 18 to be slipped into this cup unless the lamp switch 24 which had best be designed as shown, to serve simultaneously as charging contact—is in open position. The contact pins 25 and 26 may be designed without difficulty in such a manner that they shall serve at the same time to anchor the insulating body 13.

In order to use the apparatus it is merely necessary to pull the insulating cup 17—which when not in use is plugged dead on to the insulating body 13—out of the insulating body, thereupon slipping the pocket lamp 18 with open switch into the insulating cup 17. This latter is then brought into position ready for use by slipping its contact pins 25 and 26, from below, into the plug bushes 15 and 16 of the insulating body 13 in the direction shown by arrows. In this manner the pocket lamp 18 is now encased contact proof between the insulating cup 17 and the insulating body 13. It may thus be connected with the charging apparatus as safely as a plug contact (25, 26) with its corresponding plug bush (15, 16).

According to Fig. 4 the insulating cup 27, open at the top, is inseparably connected with the contact pins 28 and carries on its opposite side to the plug pins the adjoining casing 29 for the glow discharge rectifier 30. This casing is provided with an inspection opening 31, thus making the glow discharge rectifier at the same time serve as a signal lamp indicating whether the circuit of the charging apparatus is closed by the inserted pocket lamp 18. Within the insulating cup 27 the charging contacts of the pocket lamp 18 are arranged inside grooves 32 and 33—which are not interchangeable—in which the connecting poles 34 and 35 of the charging apparatus are sunk contact-proof in such a depth below the upper edge that it cannot come into contact with the charging contacts 23 and 24 of the pocket lamp 18 as long as not only the electrolyte tank but also all the outer metallic parts of the pocket lamp 18 connected with the charging contacts of this lamp are not safely encased, contact-proof, within the insulating cup 27.

To operate this charging apparatus it is merely required to let the pocket lamp 18 slip into the insulating cup 27 with open switch 24. To remove the lamp from the charging apparatus upon completion of the charging operation it suffices to pull the charging apparatus off its plug contact, to incline it and thus to let the pocket lamp 18 slip out of the insulating cup 27.

EWALD ZDANSKY.

PUBLISHED

JUNE 15, 1943.

BY A. P. C.

E. ZDANSKY

CHARGING APPARATUS FOR NETWORK CONNECTION, FOR ACCUMULATOR POCKET LAMPS

Filed Jan. 20, 1942

Serial No. 427,480

Fig 1

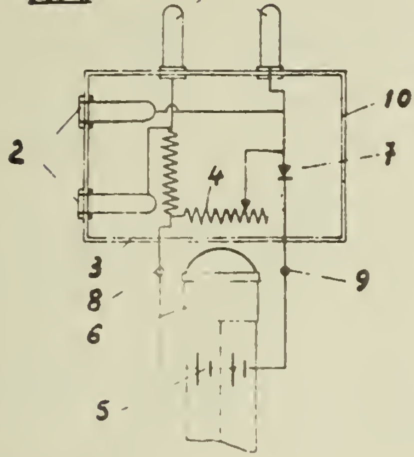


Fig 2

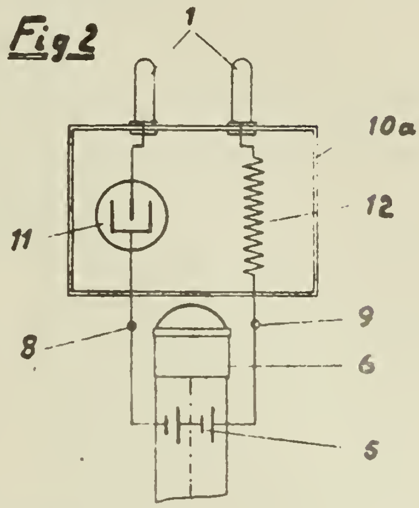


Fig 3

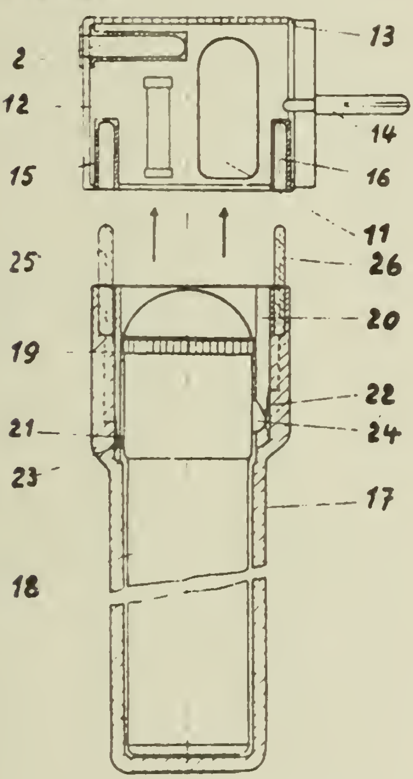
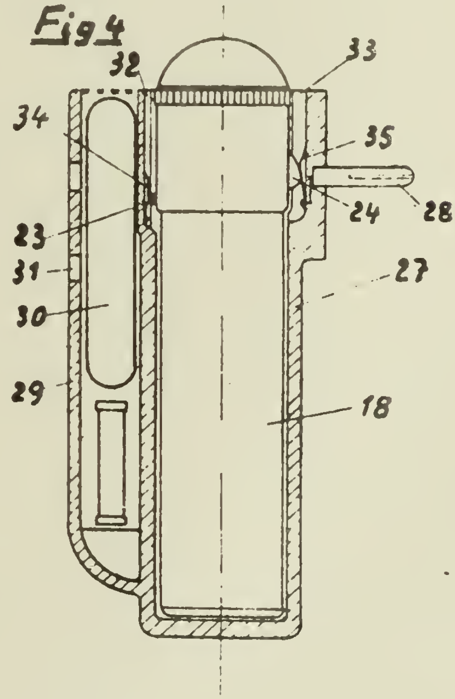


Fig 4



Inventor:
Ewald Zdansky

Attorneys:
Richardson and Geier

Published June 15, 1943

Serial No. 428,971

ALIEN PROPERTY CUSTODIAN

TELECINEMA TRANSMISSION DEVICES

Henri de France, Lyon, France; vested in the Alien Property Custodian

Application filed January 30, 1942

The present invention relates to telecinema transmission devices.

The chief object of the present invention is to facilitate the successive transmission of several films.

According to an essential feature of the present invention I provide, in a device of the type above mentioned, means for unwinding two films along two different paths and for illuminating both of these films, and means for successively operating through said films a common image transmission apparatus, such as an iconoscope, for the successive emissions of these two films.

According to another feature of the present invention, I provide a single objective for the projection of the two films thus unwound, optical means being interposed between said films and the common objective so as to substitute one of the two films to the other in the field of the objective.

Other features of the present invention will result from the following detailed description of some specific embodiments thereof.

Preferred embodiments of the present invention will be hereinafter described with reference to the accompanying drawings given merely by way of example and in which:

Fig. 1 is a diagrammatical perspective view of a telecinema transmission device made according to an embodiment of the invention.

Fig. 2 shows, also in a diagrammatic manner, a device for automatically shifting from one film to the other.

In the following description, it will be assumed that it is desired successively to transmit a plurality of films through a telecinema system.

I provide in the usual manner, on the one hand, a film unwinding apparatus, the chief elements of which are shown by Fig. 1, to wit: a spool **1**, for the unwinding of film **2**, two rollers **3** and **4** for guiding said film, preferably in a vertical direction, and a second spool **5** for the winding of the film, which is driven by means of an electric motor **6**, preferably independent.

On the other hand, I dispose a film illuminating apparatus **7** in such manner that the optical axis of said apparatus is at right angles to the film, that is to say horizontal in the example illustrated by the drawing.

Finally, I make use of an objective **8** adapted to receive the illuminated image of film **2** and to give an image thereof capable of being analyzed by an image transmitting apparatus **9**, preferably an iconoscope which is therefore mounted behind objective **8**.

It will be supposed that it is desired to operate such a device and that the film is going to be wholly unwound. It is clear that a certain time will be necessary for the replacement of the film which has just been projected by the next film which follows.

In order to obviate this drawback, according to the present invention, I provide, in such a projection system, a second unwinding device, the chief elements of which are shown in Fig. 1 by the same reference numerals, but carrying index *a*, as the corresponding elements of the first unwinding device. The second unwinding device is adapted to receive, during the operation of the first unwinding device, film **2***a* which is to follow the film that is being projected.

I further provide an illuminating device for illuminating film **2***a*. For this purpose, I make use of an apparatus **7***a* distinct from apparatus **7** and which is placed, relatively to film **2***a*, in a position analogous to that of apparatus **7** with respect to film **2**.

It would be possible further to duplicate the first described transmission device and to provide a second iconoscope or like apparatus, fitted with its objective. In this way, I would obtain a device permitting to pass immediately from the projection of the first film to that of the next one.

According to a first feature of the present invention, I make use of the same image transmission apparatus, for instance iconoscope **9**, for both of the films.

According to another feature of my invention, I preferably make use of a single objective **8** for the projection of both of the films.

For this purpose, both of the unwinding devices are arranged in a symmetrical manner, preferably with reference to a vertical plane, illuminating apparatus **7** and **7***a* being directed toward each other along a common axis I—I.

Thus after iconoscope **9** and its objective **8** have been placed coaxially with each other along a vertical axis II—II equidistant from the respective portions of films **2** and **2***a*, and at a suitable distance, it is possible to reflect along axis II—II the light beams emitted respectively and successively by the illuminated image of films **2** and **2***a*, through an optical device **10** capable of occupying two different positions.

In the example illustrated by the drawing, this device **10** consists of a pair of right-angled prisms **11** and **11***a*, the planes of the reflecting faces of which are at right angles to each other and intersect each other along a line III—III perpen-

dicular to lines I—I and II—II and passing through the point of intersection of these two last mentioned lines. These prisms are mounted in a holder 12 adapted to slide parallelly to line III—III on a support which is not shown by the drawing.

In the system which has just been described, when film 2 for instance is nearing the end of its projection, it suffices to start the unwinding of film 2*a* and simultaneously to shift optical device 10 to its second position, for obtaining the desired continuous projection.

Advantageously the system further includes a device for automatically performing, at the proper time, the shifting from the projection of one film to that of the next one.

Such an automatic control device may be made for instance in the following manner as shown by Figures 1 and 2.

The film is caused to pass through an apparatus 13 including electric contact means operated by the passage of a slot 14 provided in film 2 at the point of said film where it is to be replaced by film 2*a* for projection purposes.

The electric contact thus made connects with the terminals of a battery 15 electric circuits (shown only by Fig. 2) which respectively include:

(*a*) An electro-magnet 16*a* adapted to act on a core 17*a* so as to bring optical device 10 into the position thereof where prism 11*a* is being utilized;

(*b*) Two electro-magnets 18 and 19*a*, the first of which is adapted to open switch 20 which controls the connection with a current distribution line S of the circuits through which motor 6 and illuminating apparatus 7 corresponding to film 2, are fed with electric current, while the second, to wit 19*a*, closes switch 20*a* which plays the same part with respect to devices corresponding to film 2*a*.

On the other hand, it is advantageous to avoid having the contact elements 21 of contacting device 13 uselessly in frictional contact with film 2 over the whole length thereof. Consequently, contacting device 13 is fitted with two electro-magnets 22 and 23, which are energized a short time before the end of the film through a revolving switch 24 and which apply against each other metallic contact rollers 25 and 26, normally held away from the film by the action of solf iron counter-weights pivoted about axes 27 and 28 respectively and also included in an electric circuit.

On the other hand, switch 24 is capable of occupying a third position corresponding to the first operation, that is to say the shifting from the projection of film 2*a* to that of film 2, this operation being produced by an electric device analogous to that which has just been described and capable of displacing prisms 11—11*a* in the opposite direction.

HENRI DE FRANCE.

PUBLISHED
JUNE 15, 1943.
BY A. P. C.

H. DE FRANCE
TELECINEMA TRANSMISSION DEVICES
Filed Jan. 30, 1942

Serial No.
428,971
2 Sheets-Sheet 1

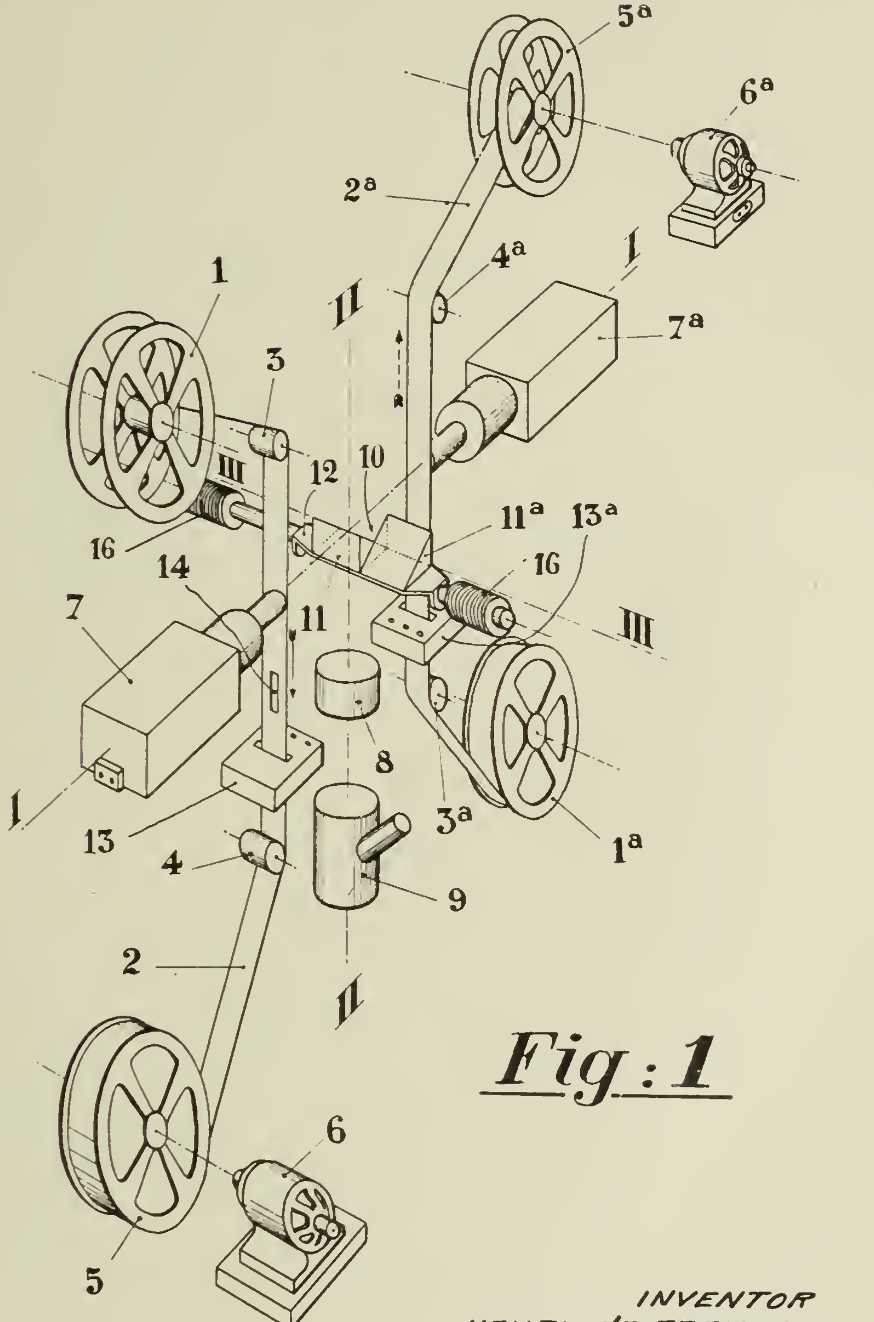


Fig: 1

INVENTOR
HENRI de FRANCE,

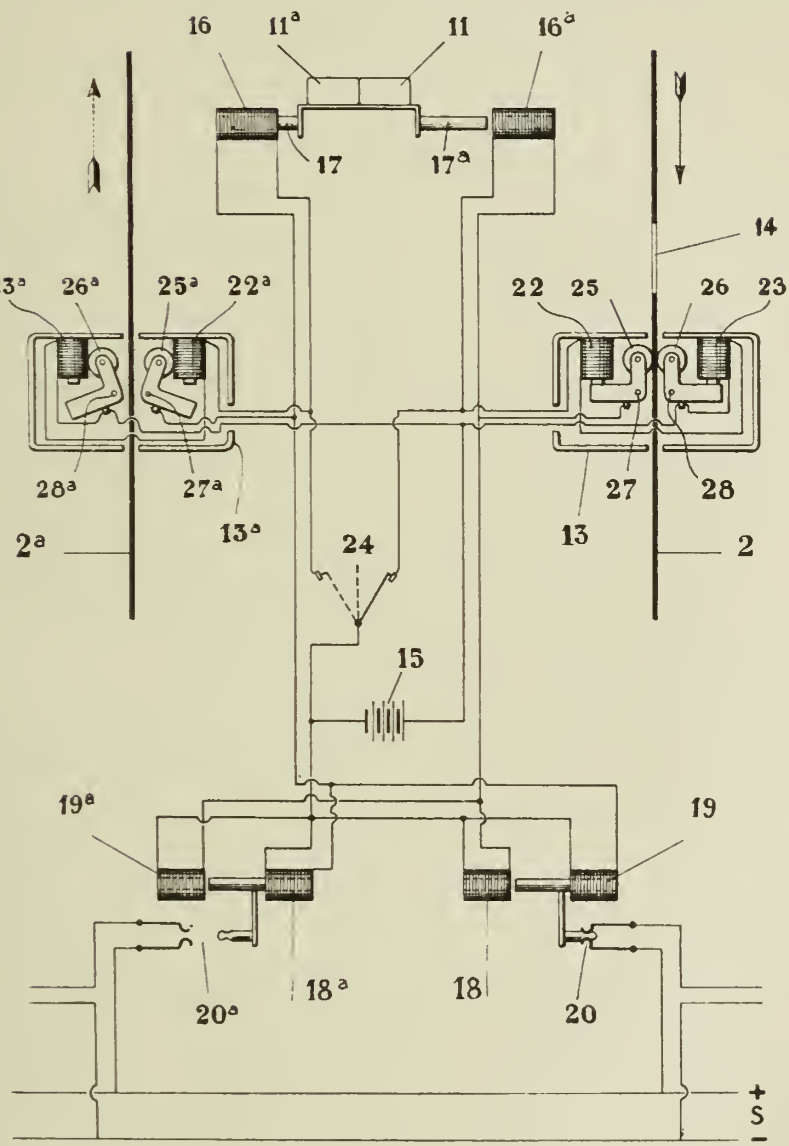
BY Bailey, Stephens & Huettig
ATTORNEYS

PUBLISHED JUNE 15, 1943. BY A. P. C.

H. DE FRANCE
TELECINEMA TRANSMISSION DEVICES
Filed Jan. 30, 1942

Serial No. 428,971
2 Sheets-Sheet 2

Fig: 2



INVENTOR
HENRI de FRANCE,

BY Bailey, Stephens & Huettig

ATTORNEYS

Published June 15, 1943 Serial No. 428,972

ALIEN PROPERTY CUSTODIAN

TELECINEMA TRANSMISSION

Henri de France, Lyon, France; vested in the Alien Property Custodian

Application filed January 30, 1942

The present invention relates to telecinema transmission and is especially concerned with systems in which the movement of the film is not continuous and more particularly when use is made of an analyzer.

The object of the present invention is to provide a system of this kind which is better adapted to meet the requirements of practice and in particular which improves the sharpness of the image that is transmitted.

According to an essential feature of the invention, the different portions of the image to be transmitted are successively projected onto the corresponding elements of the inconoscope mosaic or the like and said elements are analyzed when their respective illumination has ceased, the period of time corresponding to the analysis of the whole of said elements being longer than that corresponding to the illumination thereof, while coinciding partially with said period.

Other features of the present invention will result from the following detailed description of some specific embodiments thereof.

Preferred embodiments of the present invention will be hereinafter described with reference to the accompanying drawings given merely by way of example and in which:

Fig. 1 is a diagram indicating the time intervals during which there can be no illumination;

Fig. 2 is another diagram illustratng the succession of operations taking place, as a function of time, according to the present invention;

Figure 3 diagrammatically shows a portion of the projection device according to an embodiment of the invention;

Figure 4 is a diagrammatical view of the projection device embodying the elements shown by Figure 3.

In the following description it will be supposed that it is desired to obtain a telecinema transmission system of the kind in which the film is moved in a discontinuous manner.

This system proper is for instance made of a conventional construction including, in a known manner, a projection apparatus, an analyzer such for instance as an iconoscope, and a radio electric transmission station.

Concerning the method of analyzing the image it will be supposed in the following description that I make use of the so-called image interlacing method, the advantages of which are such that it is very widely used.

But this method involves an increase of certain drawbacks which are generally found in the present state of the art.

Thus, when the different elements of the mosaic are analyzed, while said mosaic is receiving the projection of the whole image of the film to be televisioned, it is necessary to stop both analysis and illumination as shown by the diagram of Fig. 1, in which Ot_2 is the time corresponding to an image of the film.

The time thus lost includes, on the one hand, the time interval t_1t_2 necessary for replacing an image of the film by the next image, that is to say about one sixth of the total time corresponding to the transmission of an image of the film and, on the other hand, a time interval t_3t_4 equal to the preceding one and imposed by the necessity of illuminating in the same manner the successive interlaced images.

The whole time that is lost thus corresponds to one third of the time corresponding to the transmission, which correspondingly decreases the sharpness of the image that is transmitted.

Another solution (called "memory method") has been proposed, in which the whole of the elements of the mosaic is very strongly illuminated during a short time corresponding to some hundredths of the time t, which is generally $^1/_{50}$ of a second, allowed to each interlaced image and at the beginning of this time period, while the analysis subsequently takes place in darkness. This method permits of effecting the analysis during substantially the whole of time period t, but on the other hand, it involves a serious drawback resulting from the gradual weakening of the luminosity between the analysis of the first elements and that of the last one.

The object of the present invention is to obviate all these drawbacks.

Its essential feature consists in successively projecting the different parts of the image to be transmitted onto the corresponding elements of the mosaic of the iconoscope or the like and analyzing said elements when their respective illumination has ceased, the period of time corresponding to the analysis on the whole of said elements being longer than that corresponding to the illumination of said whole while partly coinciding with this last period.

It is therefore possible, according to this method, to reduce, with respect to the memory method, the maximum time lag existing between the end of the illumination and the analysis of an element. Advantageously, I give this maximum time lag for each interlaced image a value equal to the time necessary for replacing an image of the film by the next one, that is to say about one third of the above mentioned time t.

I thus limit to an acceptable value the variation of luminosity existing between one part of the transmitted image and another part thereof. However, in order to distribute this variation over the whole of the image, the time interval between the end of the illumination of a mosaic element and the analysis of the same element is caused to vary according to a certain law, preferably a linear law, as a function of the rank of said element.

This way of proceeding is illustrated by Fig. 2 in which I have plotted in abscissas the times and in ordinates the ranks of the various elements of the mosaic taken in the order of analysis. In this diagram, I have limited by solid lines the analysis zones A and in dot-and-dash lines the illumination zones E. Point O, which is taken as origin for the times, coincides with the time at which the image of the film has just come into position and T is the corresponding time for the next image or picture. Point C is the time as which begins the displacement of the first image of the film and C_1 the homologous point for the first interlaced image. Point M, the abscissa of which is t, corresponds to the time separating the analysis of the two interlaced images that are considered. The latter are analyzed in the same manner.

In ordinates, point O represents the element of the mosaic that corresponds to the top left hand corner of the image of the film and point N represents the last element that is analyzed.

At points C and C_1, the respective abscissas of which are OC and OC_1, the illumination of the last element N must cease in each interlaced image.

At points m and u, the respective abscissas of which are M and T, the analysis of element N must also cease in each image. The analysis of the different elements taking place according to a linear law as a function of time, analysis zone A, for the first image for instance, will be limited for each interlaced image, by two straight lines substantially parallel to diagonal line Om, and very close to this line Om, since the analysis of each element takes place for a very short time.

As the respective times at which each element will be analyzed are known, it is possible to determine the period of illumination for each of them.

According to the invention, the whole of these illumination periods is distributed over at least a portion of the time corresponding to analysis. Preferably, for each interlaced image, the total period of illumination extends from the beginning of the period of analysis to the time corresponding, for the second interlaced image, to the beginning of the period of time that is lost for illumination as above referred to.

Zone E, which represents the illumination period, is therefore limited, in the direction of increasing abscissas, by a line which should substantially coincide with line OC_1 for the first image (Mc for the second).

On the other hand, the period of illumination for each element is caused to start at a time suitably remote from the end of said period. In the example shown by the diagram, I have thus limited zone E, in the direction of decreasing abscissas, by line Od_1d_2 for the first image (Od_3d_4 for the second) portion dd_1 (d_3d_4) being substantially parallel to line Oc_1 (Mc) and at a distance, in the direction of abscissas, of about one third of Oc_1.

Considering now an element of rank p, it will be seen that it is illuminated, from time e_1 during a period e_1e_2. Then it remains in darkness during a time e_2a_1, shorter than the lost time CIN equal to CT. Then it is finally analyzed during the very short time a_1a_2, an identical cycle taking place for the second interlaced image in $p_1e_3e_4a_3a_4$.

In order to carry this method into practice, I make use of any suitable means for projecting on each element the corresponding portion of the film during the time periods e_1e_2 respectively. Advantageously, the means in question are constituted by a movable shutter, preferably constituted by a disc **1** (fig. 3) provided with slots **2**, which is interposed across the path of light rays issuing from the film image (the beams formed by said rays being at this place of a section represented by rectangle **3**) and which is caused to turn about its axis.

It will be readily understood that the various elements of this device (number and shape of slots **2** and speed of revolution of disc **1**) can be chosen in such manner as substantially to obtain the periods of illumination above set forth. Advantageously, the following combination will be used:

I provide a single slot **2**, the outer edge of which is substantially given the shape of a logarithmic spiral, whereby, for a uniform speed of revolution, the speed of scanning is constant; and the development of this spiral is determined in such manner that scanning takes place for two thirds of one revolution of disc **1**.

Finally, this disc is given a speed of revolution corresponding to t per second and in the direction indicated by the arrow, which corresponds to fifty revolutions per second if the film is moving at the rate of twenty-five pictures per second as usual.

As shown by Fig. 4, the film is being unwound from spool **5** to be wound on spool **6**, the portion that is passing in front of the slot **2** of disc **1** being struck by the light beam formed by optical system **7**, which light beam is directed toward the mosaic **8** of iconoscope **9**.

Anyway, whatever be the embodiment that is chosen, I obtain a telescinema transmission system, the operation of which results sufficiently clearly from the preceding description for making it unnecessary to enter into further explanations. The system according to the invention has, over existing devices used for the same purpose, the advantage of substantially reducing the time lag between illumination and analysis of a given element of the mosaic and the further advantage of making it possible to utilize for analysis practically the whole of the time corresponding to each picture.

HENRI DE FRANCE.

PUBLISHED
JUNE 15, 1943.
BY A. P. C.

H. DE FRANCE
TELECINEMA TRANSMISSION
Filed Jan. 30, 1942

Serial No.
428,972
2 Sheets-Sheet 1

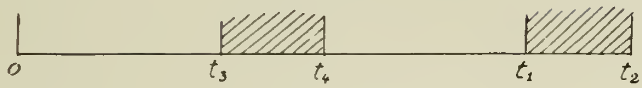


Fig.: 1

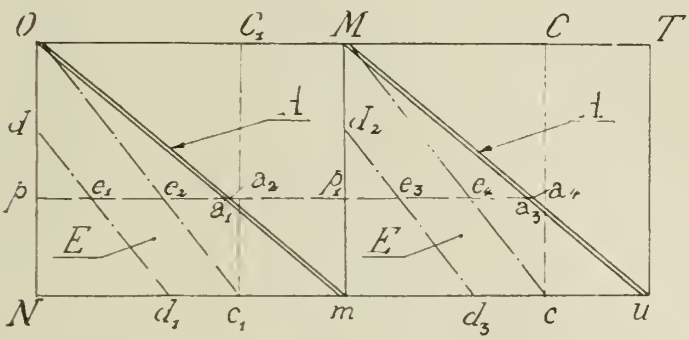


Fig.: 2

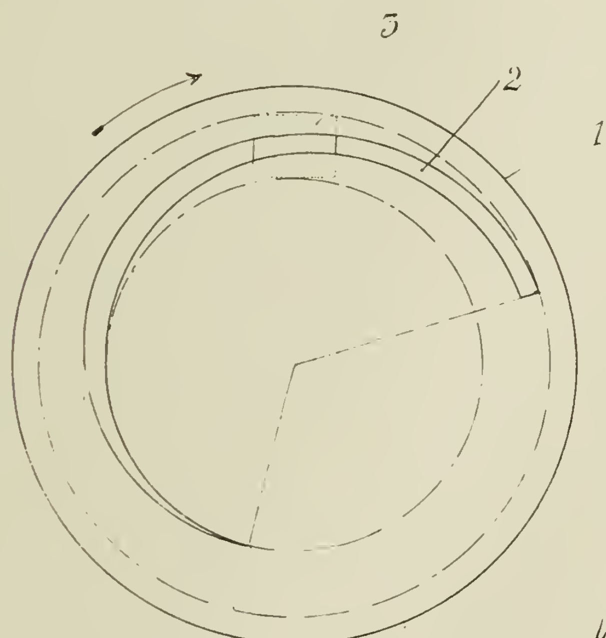


Fig.: 3

INVENTOR
HENRI de FRANCE,

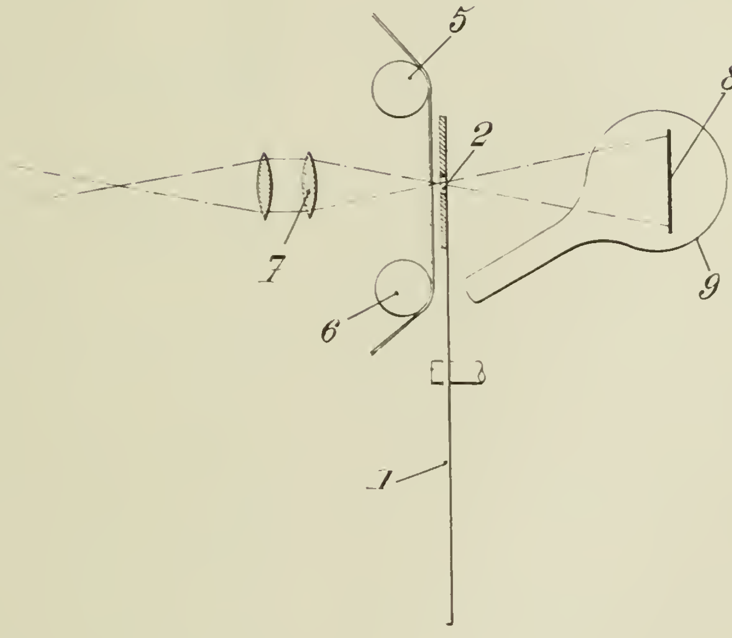
BY Bailey, Stephens & Huettig
ATTORNEYS

PUBLISHED
JUNE 15, 1943.
BY A. P. C.

H. DE FRANCE
TELECINEMA TRANSMISSION
Filed Jan. 30, 1942

Serial No.
428,972
2 Sheets-Sheet 2

Fig. 4



INVENTOR
HENRI de FRANCE,

BY Bailey, Stephens & Huettig
ATTORNEYS

Published June 15, 1943 Serial No. 428,973

ALIEN PROPERTY CUSTODIAN

TELEVISION DEVICES

Henri de France, Lyon, France; vested in the Alien Property Custodian

Application filed January 30, 1942

The present invention relates to devices for effecting the focussing of images in television cameras, that is to say in cameras in which the image to be televisioned is to be focussed on the iconoscope mosaic or, in a more general manner, on the plane in which the scanning system, which may be of any suitable type, is working.

The object of the present invention is to provide a device of the type above mentioned which is better adapted to meet the requirements of practice, and in particular which permits an increased sharpness of the focussing of the image to be televisioned.

According to an essential feature of the present invention, the television system includes means for enabling the operator to observe the image formed by the objective on the iconoscope mosaic.

Other features of the present invention will result from the following detailed description of some specific embodiments thereof.

A preferred embodiment of the present invention will be hereinafter described, with reference to the accompanying drawings given merely by way of example and in which:

Fig. 1 is a diagrammatical view of a television camera including means for checking the focussing of the image made according to an embodiment of the invention.

Fig. 2 is a diagrammatical view of a television camera according to the invention, adapted to work with infra-red light.

In the following description, it will be supposed that the invention is applied to the case of a television camera of the conventional type and is intended to permit of improving the focussing thereof.

The camera proper includes, in a known manner, a chamber 1, an iconoscope 5 including mosaic 4, and an objective 2 for forming the image of object 3 on said mosaic.

In order to focus the image of object 3 on mosaic 4, objective 2 is adjusted exactly as in the case of ordinary photography.

Up to the present time, this focussing was observed and checked by means of a sighting objective parallel to the camera objective, both of the objectives being mechanically connected together in such manner that the focussing of the image formed by the sighting objective simultaneously ensures the focussing of the corresponding image formed by the camera objective on the iconoscope mosaic.

But for practical reasons, the sighting objective is always made of an aperture considerably smaller than that of the camera objective. Consequently, the checking obtained through the sighting objective is generally imperfect and does not ensure a fully satisfactory focussing of the image on the iconoscope mosaic.

In order to obviate this drawback, according to the invention, means are provided for enabling the operator to observe the image formed by the camera objective itself on the iconoscope mosaic.

It will be readily understood that this result can be obtained in many different manners either conventional or not.

Fig. 1 shows an embodiment of a device according to the invention.

In this embodiment, the camera is fitted laterally with respect to the optical axis thereof, with a mirror 6, preferably disposed in such manner that it projects in a direction substantially parallel to said axis the image formed by objective 2 on the mosaic 4 of iconoscope 5.

In order to facilitate the observation of the image in the mirror, I provide, at a suitable place (in the rear wall of chamber 2 in the embodiment illustrated by the drawing) a view finder 7 which magnifies said image and is preferably fitted with a positive eye-piece 8 which brings the image of the mirror into correct position. This view-finder 7 is focussed, once and for all, on mosaic 4, in such manner that the focussing defects which are observed are entirely due to the imperfect adjustment of objective 2.

It then suffices to adjust objective 2 until the image observed through finder 7 is well focussed. The image formed on mosaic 4 is then certainly also well focussed.

My invention can also be applied to the case in which the scene or object to be televisioned is illuminated by infra-red or ultra-violet light that is to say a light which does not impress human eye.

Such an illumination is sometimes to be employed for instance when it is desired to illuminate an orator in a religious or official ceremony where a visible illumination could not be admitted. In such cases, the known methods for checking the focussing of the image to be televisioned could not be applied.

According to the invention as illustrated by Fig. 2, instead of making use of a direct visual examination of the optical image formed on the iconoscope mosaic, I provide the camera with an auxiliary image receiving device permitting a direct vision of the images.

As shown by Fig. 2, this device includes an oscillograph or analogous receiver tube 10 which is connected in shunt at 11 with the electric circuit through which the images are transmitted at 12. The images are thus reproduced on the screen 13 of oscillograph 10 where the operator can observe an image identical to that formed in invisible light on the mosaic 4 of iconoscope 5. The operator focusses the objective of the camera by observing the sharpness of the image supplied by the auxiliary receiving device on its screen 12.

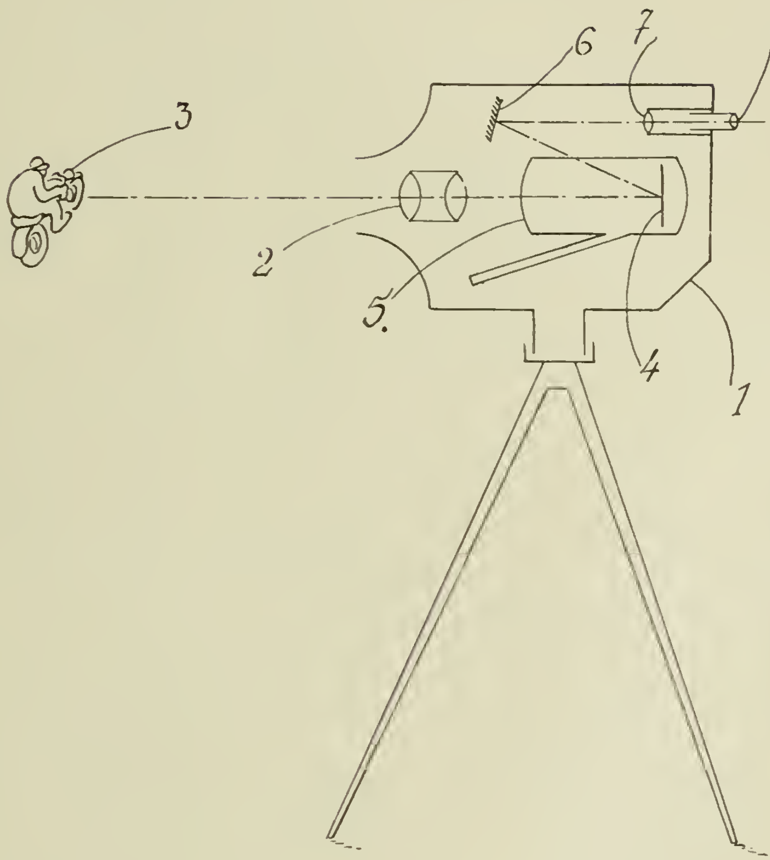
HENRI DE FRANCE.

PUBLISHED
JUNE 15, 1943.
BY A. P. C.

H. DE FRANCE
TELEVISION DEVICES
Filed Jan. 30, 1942

Serial No.
428,973
2 Sheets-Sheet 1

Fig.:1



INVENTOR
HENRI de FRANCE,

BY Bailey, Stephens & Huettig

ATTORNEYS

PUBLISHED
JUNE 15, 1943.
BY A. P. C.

H. DE FRANCE
TELEVISION DEVICES
Filed Jan. 30, 1942

Serial No.
428,973
2 Sheets-Sheet 2

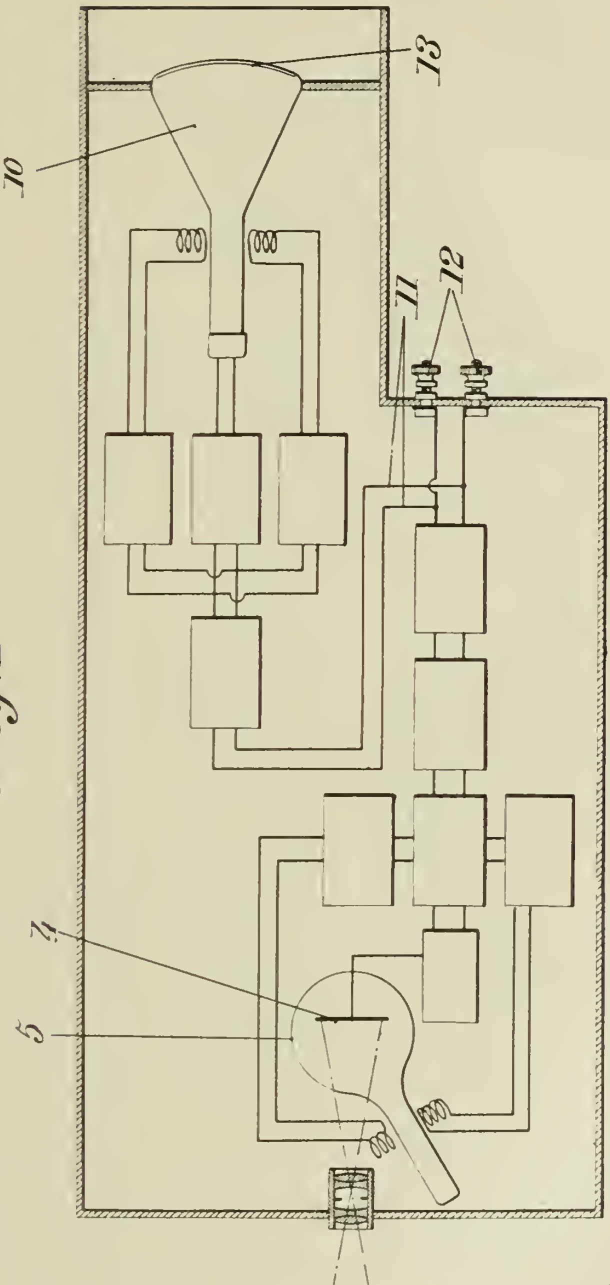


Fig. 2

INVENTOR
HENRI de FRANCE,

BY Bailey, Stephens & Huettig
ATTORNEYS

Published June 15, 1943

Serial No. 429,343

ALIEN PROPERTY CUSTODIAN

CELLULOSE BOILING

Thor Carlander, Paris, France; vested in the Alien Property Custodian

No Drawing. Application filed February 2, 1942

It is a generally known fact in the cellulose industry that a stronger cellulose is obtained if the alkaline solutions employed for boiling said cellulose contain a certain amount of soda combined with sulphur than if boiling is effected only with soda. In fact, the presence of sulphur compounds as soda monosulphide and soda polysulphide facilitates greatly the operation which consists in eliminating from the cellulose fibres the encrusting and agglutinative substances whilst reducing the force of attack of the soda on the fibres.

Until now, said sulphur compounds have been incorporated to the alkaline solutions whilst recovering the soda. In fact, the amounts of soda lost during said operation are compensated in the sulphate method by adding sodium sulphate during the filling of the melting furnace. In this case the mass coming out from the melting furnace contains, besides sodium carbonate and sodium hydroxide, sulphur compounds as sodium sulphate (Na_2SO_4) (a part not reduced), sodium sulphide (Na_2S) and small quantities of sodium bisulphite (Na_2SO_3), sodium thiosulphate ($Na_2S_2O_3$) etc. The masses coming out from the melting furnace are then causticized with lime.

The present invention consists in adding a certain quantity of preferably pulverized sulphur to the alkaline solutions employed for boiling of the cellulose and in the compositions of which enters no sulphur compounds or only a small amount thereof. Said sulphur addition is preferably effected in the washing boiler during filling thereof; however it may also be added to the prepared alkaline lye ("white lye").

The amount of sulphur to be added varies according to the nature of the vegetal material employed. Where the raw material consists in wood, there is to be added approximately 16 to 40 lbs. (according to the nature of wood employed) per 1000 lbs. of wood, supposed to be dry, for calculation. A suitable rate of sodium hydroxide weight to added sulphur weight is 8 to 1 or 9 to 1.

By adding in this manner sulphur to the (alkaline) boiling solutions the favorable influence of the sulphur compounds on the treated vegetal material is substantially increased. Thus it has been demonstrated by tests that boiling according to the present invention provides a substantial increase of cellulose output. Said increase, which has been ascertained for wood as well as for plants, is not due to incomplete de-incrustation, but probably to the fact that sodium-sulphur compounds are not formed before the boiling process reaches a very high temperature and pressure, and therefore there remains in the lye, at the high temperature and high pressure level, much sodium-sulphur compounds which reduce the force of attack exerted by the caustic soda on the cellulosic material during the very fastidious part of boiling. In industrial tests made with "Pinus Maritima" treated according to the present invention, there has been obtained a cellulose output of 50 per cent, while control tests effected according to the ordinary sulphate method have given an output of only 42 per cent. During said tests there has also been ascertained that the boiling time may be substantially reduced where boiling is effected according to the present invention.

However the adding of sulphur to the alkaline solutions provides not only an increase in cellulose output, but also an increased strength of said cellulose. Said increase is a very considerable one, compared to boiling made with caustic soda only, but it is also noticeable compared to sulphate boiling.

Furthermore, boiling according to my invention has this advantage over the ordinary sulphate method that it avoids almost completely the characteristic bad smell of sulphate works.

While there is disclosed the fundamental novel features of the invention, it will be understood that various omissions, substitutions and changes in the details of the method described may be made by those skilled in the art without departing from the spirit of the invention, and it is the intention therefore that all matter contained in the above description shall be interpreted as illustrative and not in a limiting sense.

THOR CARLANDER.

Published June 15, 1943 Serial No. 429,583

ALIEN PROPERTY CUSTODIAN

BEACON SYSTEMS

Henri de France, Lyon, France; vested in the Alien Property Custodian

Application filed February 4, 1942

The present invention relates to beacon systems of the type including radio-transmitters located on the ground and it is more especially although not exclusively concerned among these systems with those adapted to equip landing grounds, i. e. radio guides intended to permit the blind landing of air crafts.

The chief object of the present invention is to provide a system of this kind which is better adapted to meet the requirements of practise, and in particular which is more accurate, than those used for the same purpose up to the present time, while being extremely simple.

According to a feature of the present invention, a beacon system intended to mark out a straight line along the ground so as to permit of guiding an air craft along said line, includes at least two radio transmitters suitably located with respect to said line and combined in such manner that at least one of them can receive and retransmit the signals emitted by the other.

According to another feature of my invention, when it is desired to mark out a landing ground so as to permit or facilitate the blind landing of an air craft thereon, I make use of a first system for emitting radio signals and in particular a system including two transmitters for marking out an axis of the landing ground together with a second system for emitting radio signals conjugated in a suitable manner with the first signals, preferably in the way above-mentioned, whereby it is possible for the air craft's pilot to know when he is nearing the landing ground.

Other features of the present invention will result from the following detailed description of some specific embodiments thereof.

Preferred embodiments of the present invention will be hereinafter described with reference to the accompanying drawings given merely by way of example and in which:

Fig. 1 is a diagrammatical view showing the disposition on the ground of a system for marking out a certain line on said ground, such a system including two radio transmitters according to the principle of the invention;

Fig. 2 is a diagrammatical view of the screen of a cathode ray oscillograph included in a receiver system on board an aircraft or other movable engine with the indication of reception of the radio signals emitted by the beacon system of Fig. 1, according to the invention;

Figs. 3 and 4 are diagrammatical views analogous to that of Fig. 2 and corresponding to two other embodiments of the invention respectively;

Fig. 5 diagrammatically shows a landing ground and the beacon system used according to another feature of the present invention;

Fig. 6 shows an arrangement similar to that of Fig. 5, but corresponding to a landing area for seaplanes.

In the following description, it will be supposed, by way of example, that it is desired to establish a beacon system for marking out an axis such as OX (Fig. 1).

I make use of at least two radio transmitters 1 and 2, located symmetrically on either side of the axis OX in question and at a distance *d* from each other. These transmitters are adapted respectively to send two series short signals conjugated in a suitable manner, the whole being such that it is possible, on a machine, for instance an aircraft, fitted with suitable receiving apparatus, to ascertain the angular position of said aircraft with respect to axis OX from the measurement of the phase difference between the phenomena produced by the selected reception of said signal.

As for the manner in which the signals are emitted by the transmitters, according to one of the features of the present invention, at least one of the transmitters is fitted with means for receiving the signals transmitted by the other and causing the signals thus received to be retransmitted by the first mentioned transmitter. Such an arrangement permits, among other advantages, of increasing the precision with which axis OX is marked out.

Such a general principle may be applied in many different ways, some of which will be hereinafter described by way of example.

Concerning first the principle of the system relative to the transmission of the signals, this part may include transmitter stations 1 and 2, of any suitable type, at least one of which is fitted with a receiver device adapted to control its emission of signals in response to the reception of the signals transmitted by the other transmitter. Such a device can only be worked out by anyone skilled in the art.

Of course, in order to permit of selecting the two series of signals on the receiving apparatus existing on board the aircrafts, it will be advantageous to devise the two transmitters in such manner that the two corresponding series of signals are emitted with different characteristics respectively. In particular, these two series of signals may be emitted with different wavelengths.

It should be well undertsood that the signals may have the form of saw teeth different for

each series, as it has been explained in a French Patent application filed October 27, 1939, for "Improvements in Radio marking Methods for Maritime of Aerial Navigation and devices for carrying out."

Furthermore preferably and as it will be supposed to be the case in the following description, each transmitter is provided with a receiver device capable of receiving and retransmitting the signals transmitted from the other.

This last mentioned condition may be applied in different ways.

For instance, according to an embodiment of the invention, the transmission of the two series of signals by transmitters 1 and 2 may be effected independently of the means for retransmitting for each of them the signals received from the other, but preferably at the same rhythm.

According to another embodiment, the transmitters are mutually controlled by each other, transmitter 1 emitting a signal which is received by transmitter 2 and retransmitted by the latter with its own wave-length or in a general way with its own characteristics, after which transmitter 1 in turn receives the last mentioned signal and retransmits it, and so on.

I will now describe the receiving part of the system which is that to be provided on the aircrafts or other machines to be guided and which must be capable of indicating a value corresponding to the phase differences with which the two series of signals are received, whereby it is possible to determine the position of the aircraft, i. e. the angle θ made with the beacon line OX by a straight line extending from point O to point P designating the aircraft. Such a receiving apparatus is made of any suitable type, including means capable of selecting the signals coming from transmitter 1 from those coming from transmitter 2, i. e., in the case that has been considered, distinct received circuits respectively tuned to the two respective wave-lengths of the two transmitters.

Preferably, the phase difference in question is indicated visually, as also suggested in the prior Patent Application above mentioned. I may for instance make use of a cathode ray oscillograph, the control and deviating means of which are adapted to be suitably influenced by the radio signals received from the two transmitters above described.

Of course, I do not wish to be limited to such an arrangement and I might proceed in any other suitable way. For instance, I might make use of recording devices, in combination with a band or strip unwinding from a drum or I might merely make use of devices such as phasemeters tuned to the frequency of the signals.

In order to give a better understanding of the principle of my invention, I will now give some specific examples thereof.

First, it will be supposed that according to an advantageous embodiment of the receiver apparatus, the oscillograph is arranged in such manner that, through controlling devices which will be easy to provide, the reception of a signal transmitted by 1 or by 2 causes the horizontal scanning to be started in the oscillograph while producing a deviation the latter taking place for instance in one direction for the signals transmitted by 1 and in the opposed direction for the signals transmitted by 2.

On the other hand, it will be supposed that both transmitters send their signals independently and at the same rhythm.

The phenomenons occurring in the receiving apparatus are as follows:

When transmitter 1 sends a signal, the latter reaches transmitter 2 after a time interval equal to

$$\frac{d}{c}$$

seconds, c being the velocity of light. This signal is then retransmitted by transmitter 2, on the wave-length thereof and with a delay equal to t corresponding to the time constant of the system of circuits of said transmitter.

It follows that at a great distance and at a point P and the angular coordinate of which is θ, signal (1) is first received, then signal (2) after a time interval which is:

$$T=\frac{d}{c}(1-\sin\theta)+t$$

In the oscillograph, signal (1) produced at A the starting of the horizontal scanning and also a positive deviation (i. e. deviation above the horizontal line). Signal (2) produces at a point B a negative deviation, i. e. a deviation below said horizontal line.

Distance AB therefore gives a measurement of the phase difference

$$\frac{d}{c}(1-\sin\theta)+t$$

If now a short time after this (i. e. after a time sufficiently short for ensuring the persistency of the luminous impressions on the oscillograph), transmitter 2 in turn sends a signal, the latter is received and retransmitted by transmitter 1. At the receiving point P, the reception of these two successive signals takes place with the following time interval:

$$T'=\frac{d}{c}(1-\sin\theta)+'$$

Thus the oscillograph gives two new images or deviations A' and B', the horizontal scanning of the spot now starting with the reception of signal (2) which has been the first to be received.

It follows that on the oscillograph distance B—B' corresponds to the following time interval:

$$T'-T=\frac{2d}{c}\sin\theta$$

This shows that the invention permits a precision which is twice that obtained by the known methods used prior to this invention; these known methods merely involve the emission of synchronous signals by the transmitters and the phase difference is then equal to

$$\frac{d}{c}\sin\theta$$

According to the present invention, I obtain the following value of θ:

$$\sin\theta=\frac{BB'\times c}{2d}$$

and the presence of factor 2 in this formulae shows that the accuracy with which small angles are obtained is doubled for an absolute value of the reading of BB'.

If now, according to another embodiment already referred to, it is supposed that transmitters 1 and 2 are dependent upon one another, i. e. are controlled by one another, the reception may be effected in such manner that the signals

from transmitter 1 alternately start the scanning in the oscillograph in one direction (from a to b). Then, for the next signal from transmitter 1 in the opposed direction (from b to a), and so on while the signal transmitted by 2 produces deviation of the spot, as shown by Fig. 3.

This device will work in the following manner:

Segment a—b is the total segment horizontally scanned by the spot of the oscillograph. Point a corresponds to a signal from 1, point b to the next signal from 1, point a to the first signal from 1 and so on.

On the other hand, to a signal (1) corresponding to a; there corresponds a signal (2) transmitted after a time T above defined and this signal 2 is marked at A.

Likewise, to a signal (1) corresponding to point b, there corresponds a signal (2) sent after a time interval equal to T', and this signal (2) is marked at B.

Therefore:

$$aA=\frac{d}{c}(1-\sin\theta)+t$$

$$bB=\frac{d}{c}(1+\sin\theta)+t$$

so that it is clear that:

$$AB=\frac{2d}{c}\sin\theta$$

as in the first embodiment above described.

According to another embodiment which is a modification of the preceding one, the direction of the signal (2) may take place on the opposite side of the horizontal line a—b when the light spot of the oscillograph moves from b to a.

In this case, I obtain on this oscillograph screen an image such as shown by Fig. 4, with which it is possible to read in a very accurate manner the value of distance A—B even when it is tending toward zero. Furthermore, the sign of angle θ can be appreciated, according as the upper signal is on the right hand side or on the left hand side of the lower signal, since it is thus possible to know which of the two signals corresponds to a or to b.

Whatever be the specific embodiment that is chosen, I obtain a system the operation of which results sufficiently clearly from the preceding description for making unnecessary to enter into further explanations.

This system has, over systems used prior to my invention, many advantages, among which the following may be cited:

(a) The indications are read directly on the oscillograph screen;

(b) It is possible to obtain a very high accuracy;

(c) It is possible to determine the sign of angle θ;

Of course, it should be well understood that this beacon system can be used in all kinds of applications.

For instance, as above stated, it may be used for marking out the axis of a landing ground so as to permit blind landing.

An examination of the oscillograph then permits of determining axis OX and of bringing the course of an aircraft into coincidence with this axis in such manner that the air craft will land in the vertical plane passing through said axis.

In this case, it is necessary to provide supplementary means for enabling the pilot exactly to appreciate the position of landing ground with respect to said vertical plane.

The present invention therefore includes for this purpose, some supplementary features such as will be hereinafter described and which can be used separately (i. e. whatever be the manner in which axis OX is marked out).

According to one of these features I combine with a first transmitter system capable of marking line OX, a second transmitter system located at a distance D from the first along said line and conjugated with said first transmitter system in any suitable manner owing to which it is possible to deduce from the phase difference between the two series of signals received, the position of the aircraft along line OX, i. e. to know when it is nearing the landing ground OTe.

For this purpose, for instance, such a system includes the following elements:

(a) On the one hand (Fig. 5) at least two radio transmitters 1 and 2 serving to mark out line OX. This transmitter may be of the type emitting synchronous signals, of the above described type, or of any other suitable type;

(b) On the other hand, at least one transmitter 3 located along line OX, either ahead of the landing ground, as shown, or behind said landing ground, this first transmitter being capable of sending signals suitably conjugated with those transmitted by 1 and 2.

Advantageously, and according to a feature of the invention, this conjugation may be performed in such manner that the signals of transmitter 3 are received and retransmitted by transmitters 1 and 2, or vice versa.

For instance, supposing that transmitter 3 is located as shown by the drawing, and supposing also that transmitters 1 and 2 receive the signals from 3 and retransmit them, the whole system works as follows:

If the airplane is beyond transmitter 3 the time interval between the reception of the signals from 1 and 2, on the one hand, and the signals from 3, on the other hand, is substantially:

$$\frac{2D}{c}+t$$

c being the velocity of light and t the time constant of circuits 1 and 2. In this case, the aircraft cannot appreciate its distance from the landing ground.

But, when said aircraft has moved past transmitter 3, the time interval in question becomes:

$$\frac{2D}{c}+t-\frac{2R}{c}$$

R being the horizontal distance form the aircraft to transmitter 3.

It follows that if it is possible to distinguish, on the aircraft, for instance by means of an oscillograph, the signals from 1, from 2 and from 3, the pilot will be enabled first to keep its aircraft in the vertical plan passing through OX and also to appreciate exactly its horizontal distance from the landing ground.

In order to permit a good selection of the various signals that are received, transmitter 3 may emit signals having characteristics different from those of transmitters 2 and 3, for instance it may send its signals on a valve-length different from those of the other signals.

From practical purposes, I may advantageously choose for d the distance ranging from 1 to 2 kilometers and for D a distance averaging 15 kilometers.

Of course, the embodiment above described constitutes only one example of my invention. It

may be modified without departing from the principle of said invention. For instance, transmitter 3 must not necessarily be located on the perpendicular passing through the middle point of line 1, 2 and the beaconing OX might be oblique with respect to said line 1, 2.

Any way, I may obtain, according to the invention, a system which enables the pilot to land very safely along an axis marked by the beacon system, with the help of his altimeter or any other equivalent means, since the pilot knows at any time the exact horizontal distance between his aircraft and the landing ground.

Of course, a system according to my invention might be adapted to different places or geographic arrangements as may exist.

For instance, I have shown in Fig. 6 the equipment of a base for seaplanes.

In this case, transmitters 1, 2 and 3 might eventually be disposed on floats.

HENRI DE FRANCE.

PUBLISHED
JUNE 15, 1943.
BY A. P. C

H. DE FRANCE
BEACON SYSTEMS
Filed Feb. 4, 1942

Serial No.
429,583
2 Sheets-Sheet 1

Fig. 1

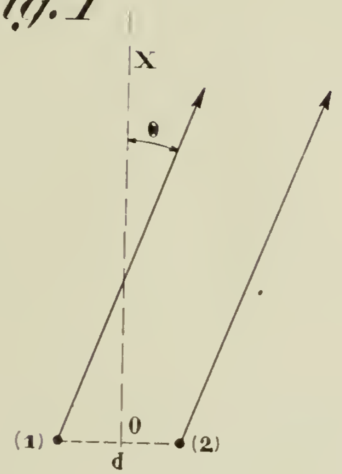


Fig. 2

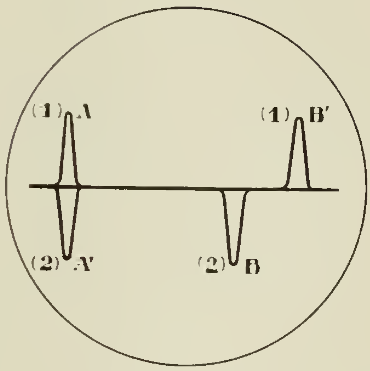


Fig. 3

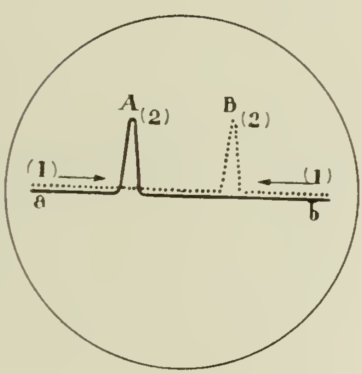
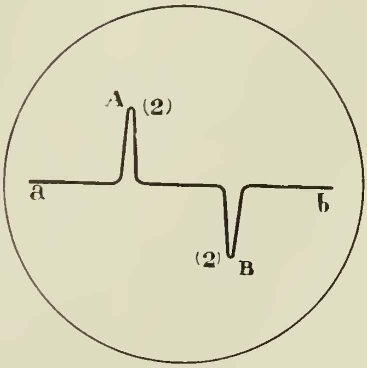


Fig. 4



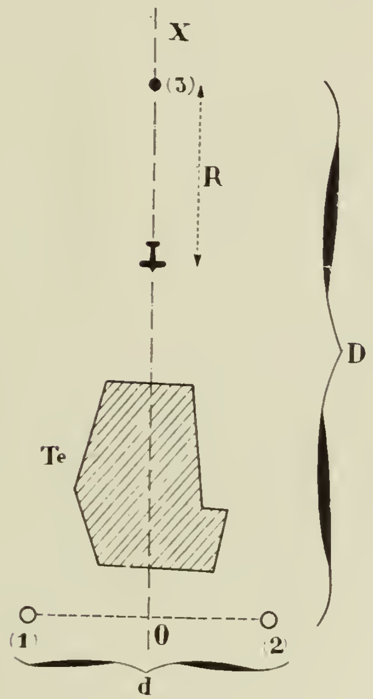
Inventor
HENRI de FRANCE,
By Bailey, Stephens & Huettig
Attorneys

PUBLISHED
JUNE 15, 1943.
BY A. P. C.

H. DE FRANCE
BEACON SYSTEMS
Filed Feb. 4, 1942

Serial No.
429,583
2 Sheets-Sheet 2

Fig. 5



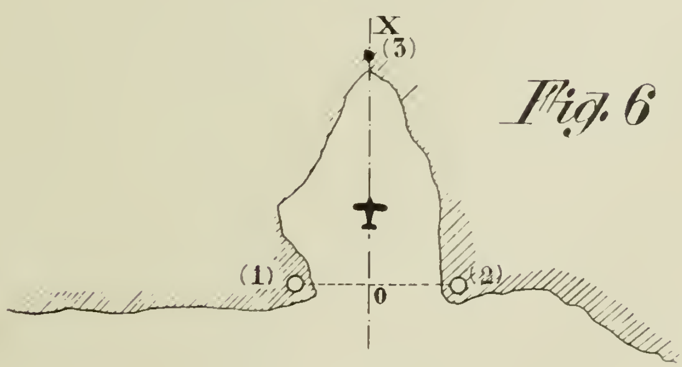


Fig. 6

Inventor
HENRI de FRANCE,

By Bailey, Stephens & Huettig

Attorneys

Published June 15, 1943 Serial No. 431,003

ALIEN PROPERTY CUSTODIAN

INTERNAL COMBUSTION ENGINE

Victor Breslav, Brussels, Belgium; vested in the Alien Property Custodian

Application filed February 16, 1942

My invention relates to a device for varying the compression ratio in an internal combustion engine.

Two opposed tendencies can actually be observed in the construction of internal combustion engines of the "Diesel" type.

The first of these tendencies, which results from the necessity of obtaining the starting from cold of the engine at any outer atmospheric temperature, tends to admit high compression ratios for the engine.

On the contrary, the second of these tendencies, which has in view to diminish the fatigue of the mechanical parts of the engine, as well as the development of heat in the joints, tends to admit the lowest possible compression ratio which is consistent with a good combustion of the fuel, at the normal working speed of the engine under full load.

Moreover, a great number of modern engines are supercharged, that means that at the beginning of the compression stroke the cylinders are filled with air supplied by a ventilator or a compressor under a pressure above atmospheric. As the starting of the engine is always operated at a number of revolutions which is much lower than that of the normal working speed, the supercharging does not produce any noticeable effect at that moment, and the compression ratio for starting the engine must be determined so as to ensure the starting from cold without taking into account the supercharging. That gives rise to absolutely excessive compression ratios at the normal working speed.

Searches have been made in view of establishing devices for reducing the compression ratio of an engine after starting and the well known proposal has been made to subdivide the total volume of the combustion chamber into two compartments communicating with each other through a narrow channel which is obturated by means of a needle for starting. This structure has the disadvantage that the communication between the air contained in the second compartment and the compartment in which the fuel is injected is formed by the abovementioned narrow channel only, so that said air cannot aid the combustion with the desired efficiency. Now, it is just at the normal working speed and under full load that the total amount of air available must be effective.

In order to eliminate these disadvantages, my invention provides a very simple device in which the same general form of the combustion chamber is maintained for the two extreme compression ratios.

My invention is particularly intended to be applied to internal combustion engines in which the cylinder head is replaced by an element which is, or not, movable during the working of the engine and forms the inner end wall of the cylinder in which it is slidably mounted, said element being connected by the aid of a link mechanism to a fixed shaft to which the pressure developed by the explosion is transmitted.

According to my invention, the shaft on which the element slidable in the cylinder is rotatably mounted, has an intermediate cranked portion and can be given, at will, an angular displacement of about 180° for causing the movement of the sliding element between two distinct positions and modifying the volume of the combustion chamber, the centre of eccentricity of said shaft in its two extreme positions and the centre of rotation of this shaft being approximately located in alignment with the direction of transmission of the strain developed by the compression and the combustion, the arrangement being such that the displacements imparted to the sliding element by the cranked shaft may take place without depending on the displacements which this element might effect at each revolution of the engine for controlling the distribution thereof.

Two embodiments of my invention will be hereinafter described with reference to the accompanying drawings, in which:

Fig. 1 is an axial sectional view of a first embodiment of my invention;

Fig. 2 is an axial sectional view taken at right angles to Fig. 1;

Fig. 3 is an axial sectional view of another embodiment of my invention, and

Fig. 4 is an axial sectional view taken at right angles to Fig. 3.

As shown in the drawings, the inner end wall of the cylinder **5** having a piston **6** slidably mounted therein, is formed by a sliding element **7**. A shaft **8**, having a crank pin **9**, is arranged diametrically relative to the cylinder and is pivotally mounted in bearings **10** which are rigidly supported by the end of the cylinder **5**.

In the embodiment of my invention illustrated in Fig. 1, the connection between the shaft **8** and the sliding element **7** is formed by a block **11** which is rotatably mounted on the crank pin **9** and is slidably arranged in a slide **12** formed in an outer extension of the element **7**.

On an extension **13** of the shaft **8**, there is fixed a control lever **14** provided with an elastical lock-

ing bolt 15 which cooperates with notches 16 formed in a sector 17 integral with the engine, for alternately locking said control lever in two extreme positions spaced apart about 180° from one another.

An angular displacement of the lever 14 causes a corresponding rotation of the shaft 8, the crank pin of which carries the block 11 with it during its eccentric movement, thus producing a sliding movement of said block in the slide 12 and an axial displacement of the sliding element 7. According to the direction of the angular displacement of the lever 14, the sliding element 7 is brought from its lowermost position into its uppermost position, or inversely.

In the two extreme positions of the element 7, each of which corresponds to a different volume of the combustion chamber, the geometrical axis *a* of the shaft 8, as well as the axis *b* of eccentricity of the crank pin 9, must be located substantially in an axial plane of said sliding element, in order that the strains applied to the latter during the compression and the combustion might not give rise to a torsional moment which would tend to make automatically rotate the shaft 8. The locking bolt 15, which maintains the control mechanism in the desired positions, also prevents any unsetting which might result from the vibrations of the engine while working.

To start the engine, the lever 14 is put into its locked position corresponding to the lowermost position of the sliding element in the cylinder, in order to obtain the highest compression-ratio. Already after a few revolutions and before the engine attains its normal working speed, the locking bolt 15 is removed and the lever 14 is turned over and is then locked in its position corresponding to the uppermost position of the element 7, which corresponds to the normal working speed of the engine.

The stroke of the element 7 is indicated in Fig. 1 and corresponds to the distance *c* between the two extreme angular positions of the axis of eccentricity of the crank pin 9.

The connection between the shaft 8 and the sliding element 7, as shown in Figs. 1 and 2, could also be formed by a rod pivotally connected to said shaft and said element, or by any other mechanism capable of transforming the angular movement of the cranked shaft into a rectilinear movement of the sliding element. The embodiment shown in Figs. 1 and 2 is given by way of example only.

The embodiment shown in Figs. 3 and 4 concerns the application of my invention in the particular case of an engine in which the movable element forming the inner end wall of the cylinder operates as a distributor piston actuated by means of a knee joint which is positively controlled by cams.

In this case, there is a supplemental condition in view of which it is necessary that the axis of eccentricity of the crank pin 9 be located in its two extreme positions at the same distance from the centre of the cams, as otherwise the mechanism would not be positively controlled.

The exhaust ports 18 of the engine according to this embodiment, are controlled by the movable element 7 which here operates as a distributor piston. The latter is provided with an axle 19 having a rod 20 rotatably mounted thereon, the other end of which is rotatably mounted on a pivot 21 carrying a roller 22 which is guided by a cam 23. At the ends of the pivot 21, there are fixed two webs 24 rotatably mounted on the shaft 8 to which the pressure resulting from the compression and the combustion are applied. Rollers 25 are rotatably mounted on extensions of the webs 24 and are guided by two cams 26.

The cams 23 and 26 are positively operating, i. e. that their outlines are combined so as to impart to the webs 24 the same law of movement about the shaft 8 and to exactly determine at every moment the position of the distributor piston 7.

In this known distributor mechanism, the shaft 8 according to my invention is provided with a crank pin 9 which is eccentric relative to the bearings 10 and upon which the webs 24 are rotatably mounted. Every angular movement of the shaft 8 causes a displacement of the axis of rotation of said webs, determined by the radius of eccentricity R (Fig. 4) of said crank pin. This displacement causes a stroke C (Fig. 3) of the movable element 7, which modifies the volume of the combustion chamber without varying its general form.

The radius of eccentricity R is determined so as to obtain the desired position of the element 7 for the starting of the engine.

Moreover, the amplitude of the required angular movement of the shaft 8 is determined in such a manner that the centre of rotation of the webs 24 be located, both in the starting position and in the position for the normal working speed of the engine, on a concentric circle relative to the cam shaft 27, in order to ensure a positive operation of the cams.

In the embodiment shown in Figs. 3 and 4, as well as in that illustrated in Figs. 1 and 2, the shaft 8 is controlled by a lever 14 which is fixed in its extreme positions by the locking system 15, 16, 17.

The little unsetting of the distribution resulting from the increase of the overlapping of the exhaust port 18 by the movable element 7, does not have practically any influence upon the free running of the engine while starting. The stroke of the element 7 acting as a distributor piston which is influenced by the positively acting cams, is effected as well under the action of the highest compression as when the engine is running at its normal speed.

VICTOR BRESLAV.

PUBLISHED

JUNE 15, 1943.

BY A. P. C.

V. BRESLAV

INTERNAL COMBUSTION ENGINE

Filed Feb. 16 1942

Serial No.
431,003

FIG.1.

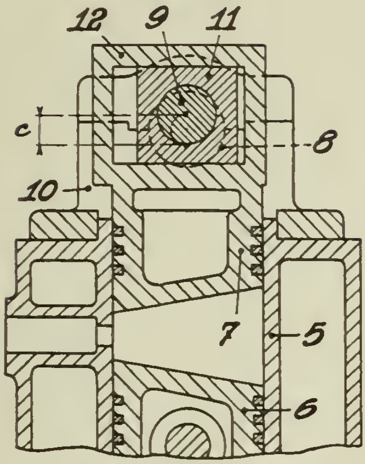


FIG.2.

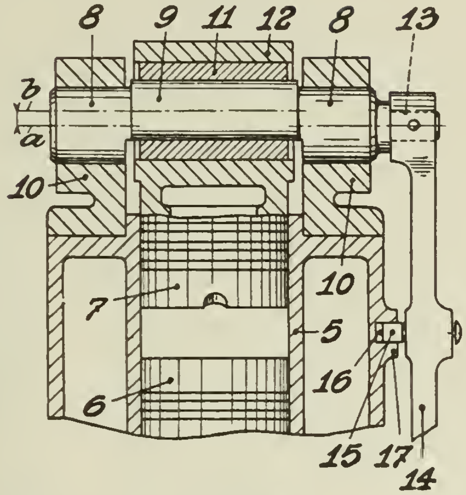


FIG.3.

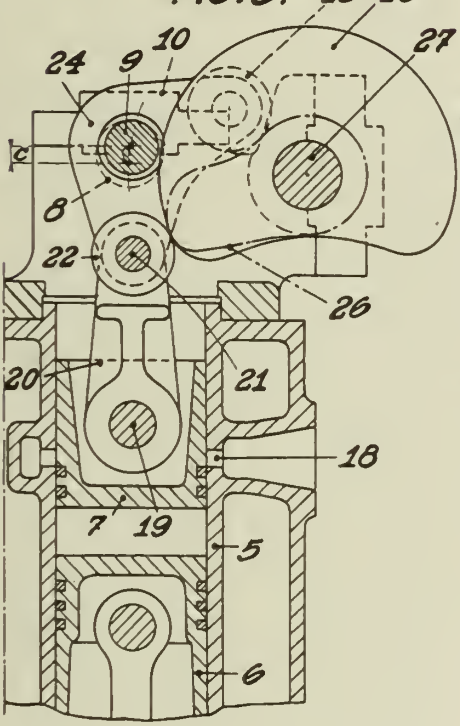
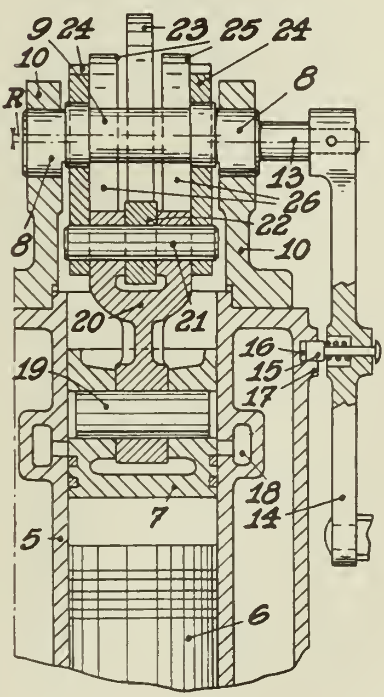


FIG.4.



INVENTOR.
Victor Breslav

BY
Singer Ehlert Stern & Carlberg
ATTORNEYS

Published June 15, 1943 Serial No. 444,734

ALIEN PROPERTY CUSTODIAN

MULTI-DRIVE GEAR BOX FOR ACCESSORIES ON BOARD AIRCRAFT

Charles Raymond Waseige, Saint-Etienne, (Loire), France; vested in the Alien Property Custodian

Application filed May 27, 1942

The present invention has for its object to improve the multi-drive gear boxes recently used for driving auxiliary devices or "accessories" on board aircraft.

With the gear boxes as hitherto used, it often happens that the engine power take-off, from which said boxes are driven, does not rotate at the speed at which the electric generator, which is mounted on the gear box casing and driven by means of a pair of conical toothed wheels, is to rotate.

On the other hand, a multi-engined aircraft is preferably provided with engines rotating in opposite directions. The manufacturer of accessories is thus compelled to build two types of electric generators, this resulting in complications for the users with regard to maintenance, spare parts, etc.

Besides, on engines having a very reduced transverse bulk not only there is no space for mounting the various accessories which are to supply the various needs on board, but it becomes difficult to lodge even a starter.

It may also happen that the available space does not permit of mounting the standard gear box for a given engine in alignment with the engine power take-off.

The invention aims at doing away with these various drawbacks and has for its subject-matter a plurality of features which may be used together or separately, depending upon the particular cases.

One of these features consists in that the gear box comprises a speed multiplying or reducing gear between the driving shaft and the electric generator, said multiplying speed gear consisting preferably of a planets-carrier driven by the driving shaft and whose planet pinions, which are conical and have their axis inclined to the vertical, roll on two sun wheels of different diameters, the largest of which is secured to the box casing and the other keyed on a shaft driving the electric generator, or the reverse.

In a convenient embodiment of the aforesaid arrangement, the planets-carrier is provided with a journal supported in bearings of the box casing and through which extends the driving shaft coming from the engine, the inside of said carrier being formed as a spherical bearing socket in which is mounted a hollow joint ball rotatively connected in a floating manner on the one hand with the planets-carrier by means of outer splines and, on the other hand, with the said shaft by means of inner splines.

Whatever may be the construction of the speed multiplying or reducing gear, the latter is preferably contained in a compartment of the casing.

Another feature consists in that the gear-box is provided with a reversing gear, which may be formed either as a removable unit adapted to be applied upon the box casing, or as a permanent part of the gear box, being then provided with two couplings one or the other of which may be used.

In a convenient embodiment of a multiplying, reducing or reversing gear, which is more particularly advantageous in that the overall length may be reduced, the whole of the multiplying, reducing or reversing gear is carried by a floating casing centered between the engine and the box on the cardan driving shaft and held against rotation by a stop on the box casing.

Still a further feature consists in that the starter is secured on the box casing and that a gearing embodied in the gear box connects said starter with the driving shaft, the latter thus serving also for starting the engine.

When the gear box cannot be arranged in alignment with the power take-off of the engine, the measure adopted consists in that the shaft which is to be actuated by the shaft coming from the engine is an intermediate countershaft carried by an angularly adjustable casing carried so as to be capable of being turned around the shaft entering into the box casing for driving the transmission elements of said box and of being fixedly held in any one of a plurality of possible positions.

It is more particularly advantageous that the various aforesad devices, i. e. the reversing, multiplying or reducing gear, the angularly adjustable gear box, etc., comprise casings all adapted to be mounted upon the same opening of the gear box.

Lastly, in some cases namely on multi-engined aircraft, the gear box is associated with an own auxiliary engine by which it is driven to provide for various needs.

Particular embodiments of the above-mentioned features are illustrated as non limitative examples on the annexed drawings, in which:

Fig. 1 shows a speed multiplying gear for an accessories driving gear box;

Fig. 2, a removable reversing gear for an accessories driving gear box;

Fig. 3, a reversing gear forming an integral part of an accessories driving gear box;

Fig. 4, a floating reversing gear;

Figs. 5 and 6 are respectively front and side

views showing schematically a gear box provided with a displaceable countershaft;

Fig. 7 is a section on the line VII—VII of Fig. 5, at a larger scale;

Fig. 8 is a similar view to Fig. 7, but shows an ordinary casing interchangeable with an angularly adjustable casing;

Fig. 9 is a fragmentary elevational diagrammatic view showing an engine and an accessories driving gear box carrying the engine starter;

Fig. 10 is a similar view to Fig. 9 and shows the modification of the connection between the engine and the gear box when the latter is additionally provided with a floating reversing gear.

In the examplary embodiment of Fig. 1 there is shown only the casing 1 of the gear box used for driving accessories, which gear box may be of any known type. Into an opening 2 of this casing is adapted to be fitted another casing 3, in the bottom of which is lodged a roll bearing 4 fitted onto the hub 5 of a conical gear wheel provided with two sets of teeth 6, 7, and located inside the casing 1. On the other side of said bottom is arranged a conical gear wheel 8, the stem or tail 9 of which is keyed in the hub 5. The wall of the casing 3 remote from said bottom consists in a cover 10 carrying on its inner side a conical set of teeth 11 co-axial with the wheel 8. In said cover is centered co-axially with said wheel 11, by means of roll bearings 12, the hollow stem 13 of a member 14 provided outwardly with two or three inclined journals 15 each carrying a planet pinion 16, the whole arrangement being such that the planet pinions gear with both the set of teeth 8 and 11, which form sun rolling tracks. Inside the planets-carrier 14 is machined a spherical bearing surface 18, located in a cylindrical chamber the inner wall of which is provided with splines 19. On said bearing is resting a ball 20 held in place by a cover-plate 21 provided with a spherical bearing and secured onto the end of the planets-carrier 14. The ball 20 is provided on its outer surface with short splines 23 engaging with the grooves 19, and said ball is further provided co-axially with the planets-carrier with a splined through hole 25 into which engages the similarly splined end of the driving shaft coming from the engine.

It will be apparent that the assembly just described forms a self-contained and unitary epicyclic speed mutiplying gear.

If the diameters of the wheels 8 and 11 be reversed, the ratio will be changed, which may be useful in some cases. If there is no need of a multiplying gear in the relay, the assembly may be removed as a whole and replaced by another assembly comprising only a gear wheel, such as the double gear wheel 6, 7, integral with the ball and socket joint for the connection with the shaft coming from the engine.

The embodiment of Fig. 2 shows how one may reverse the rotation only, without at the same time changing the speed ratio; this embodiment, which constitutes only a removable reversing gear, differs from that of Fig. 1 only in that, instead of carrying planet pinions, the member 14 carries a set of conical teeth 28, of the same diameter as the wheel 8, and which meshes with one or several stationary intermediate pinions 29, also in mesh with said wheel 8. Each pinion 29 is supported in roll bearings 30, secured to the casing 3, with its axis at right angles to the common axis of the wheels 8 and 28.

In this case also the speed may be mutiplied or reduced according as the axis of the pinions 29 is inclined on one or the other side.

The embodiment of Fig. 3 is similar with that of Fig. 2 by the use of stationary intermediate pinions 29c, gearing with the wheels 8c and 28c, but it differs in that through the inside of the stem or tail of the wheel 28c extends an intermediate shaft 33 protruding at one end from the cover 10c of the casing 3c, in which cover it is supported by means of a roll bearing 34, its opposite end being centered in a socket 35 provided on the wheel 8c. On that part of said shaft 33 located between the wheels 8c and 28c is slidably splined a clutch collar 36 having two opposite annular sets of clutching claws 37 adapted to co-act with similar sets of claws 38 provided respectively on the wheels 8c and 28c; a pin 40 holds the collar 36 in the one or the other of its two clutching positions. It is obvious that for a given direction of rotation of the shaft 33, the gear 6, 7 will rotate either in the one or the other direction, in accordance with said clutching position; the protruding part of the shaft 33 carries the ball and socket joint 41 for connection with the shaft coming from the engine, which joint is similar to those previously described and is only keyed onto said protruding part.

In the embodiment of Fig. 4, the opening 2 of the casing 1 is capped by a cover 44 the bottom of which presents a hole in which is fitted a roll bearing 45 supporting the stem 46 of a cup 47 having a spherical seat and on which is screwed another cup 48, provided internally with another spherical seat. The cup 48 is outwardly provided with a stem 49 co-axial with the cup 47 and on which is secured the double gear wheel 6, 7 driving the box gears. Between the cups 47, 48 is arranged a ball 50 which carries a shaft 51 projecting outwardly from the cover 44 through the stem 46. The ball 50 is provided outwardly with short splines 52 in engagement with splines 53 cut inside the cup 48. On the protruding part of the shaft 51 is keyed the stem 55 of a conical gear wheel 56 which is further provided with a central cylindrical cup 57 for centering the end of the shaft 58 coming from the engine. On a bearing surface of said shaft 58 is keyed a conical gear wheel 59 on the stem of which is fitted a roll bearing 60; other roll bearings 61 are fitted on the stem 55. These roll bearings 60 and 61 are fitted outwardly in recesses of an outer casing 63, which is solely supported thereby, and the rotation of which is prevented by a pin 64 fastened to the casing 44 and entering loosely into a perforated lug of said casing 63. In roll bearings 66 fixedly carried in the latter are mounted one or several intermediate pinions 65 gearing with the wheels 56 and 59.

The assembly thus constituted, supported solely by the co-axial cardan shafts 51 and 58, is a floating assembly. This arrangement permits to mount a reversing gear without increasing the overall length or, for a given length, without reducing the distance between the cardans.

By inclining the axis of the intermediate pinion 63, as previously described with respect to Fig. 1, a multiplying or reducing gear of the floating type may likewise be obtained. Instead of a conical wheel transmission, the assembly may comprise a spur wheel transmission having a counter shaft parallel with the driving shaft. This would constitute a multiplying or reducing gear assembly without reversing, since the direc-

tion of rotation of the gear box would be the same with or without said assembly.

In Fig. 6, it will be seen that the available space in the cowling **70** containing the engine **71** does not permit of mounting a standard gear box **72** so that its driving shaft will be in alignment with the power take-off **73** of the engine. The standard drive head may then be substituted with a casing **74** inside which is mounted a counter-shaft **75** (Fig. 7) supported in roll bearings **76** fitted in said casing and carrying the ball coupling member **77** with the driving shaft **78**, the other end of which is connected to the power takeoff **73** of the engine; a gear wheel **79** keyed on the countershaft **75** gears with a pinion **80** secured to a shaft **81** located co-axially with the axis X—X of the gear box and carried in roll bearings **82**, fitted in the casing **74**, said shaft **81** extending into the casing of the gear box **72**, where it carries the gears for driving the various members of said gear box. The casing **74** may be turned around the axis X—X and locking means, such as studs **83** or the like, are provided for holding it stationary in any one of its angular positions, some of which are shown in Fig. 5.

It will be observed that in all said embodiments shown in Figs. 1 to 7, the casing **1** of the gear box and its opening **2** have received no modification whatever and that any one of these embodiments may thus be mounted upon said opening, according to the problems in view.

In Fig. 8, instead of an angularly adjustable casing **74** is shown a casing **84**, which is interchangeable therewith and contains a hollow shaft **85** and its ball coupling member, arranged to be co-axial with the axis X—X of the gear box. In order to facilitate this substitution, a coupling **86**, of any suitable type, is provided between the shaft **87**, which is a permanent part of the gear box, and the shaft **81** of the angularly adjustable casing, as well as the shaft **85** of this direct drive casing **84**. A similar coupling may obviously also be used on the speed gears, reversing gears, etc.

In the embodiment shown in Figs. 9 and 10, the casing **90** of the gear box, which as shown is a very flat casing consisting of a base and a cover, although a casing of any other suitable type may be used, presents an opening **91** receiving the nose of a starter **92** arranged opposite a clutching claw **93** supported in roll bearings **94** carried in the casing. A toothed wheel **95** keyed on said claw **93** gears with a toothed wheel **96** keyed on the tail **97** of a member **98** protruding out from the casing, and which is the member adapted to be coupled by a ball and socket joint with the shaft **99** leading to the power take-off **100** of the engine **101**. The starting of the engine is thus effected from the starter through the medium of the wheels **95** and **96** and the shaft **99**. A toothed wheel **102** keyed on the claw **93** drives gear trains **103** leading to the various accessories to be driven, such as **104**, for example.

Fig. 10 shows how the preceding arrangement is modified by the addition of a floating reversing gear **105** of the type shown in Fig. 4.

Obviously, the invention is in nowise limited to the details of construction shown or described, which have only been given as examples.

CHARLES RAYMOND WASEIGE.

PUBLISHED

JUNE 15, 1943.

BY A. P. C.

C. R. WASEIGE
MULTI-DRIVE GEAR BOX FOR ACCESSORIES
ON BOARD AIRCRAFT
Filed May 27, 1942

Serial No.
444,734

3 Sheets-Sheet 1

Fig. 1

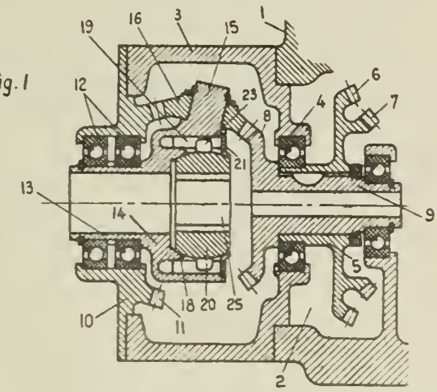


Fig. 2

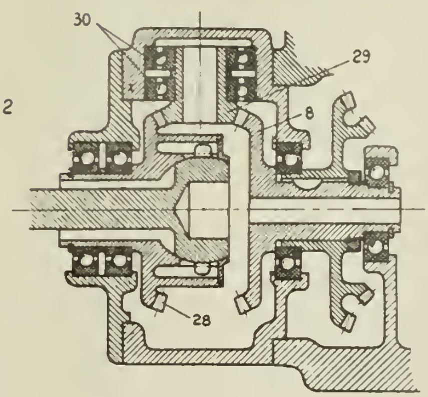
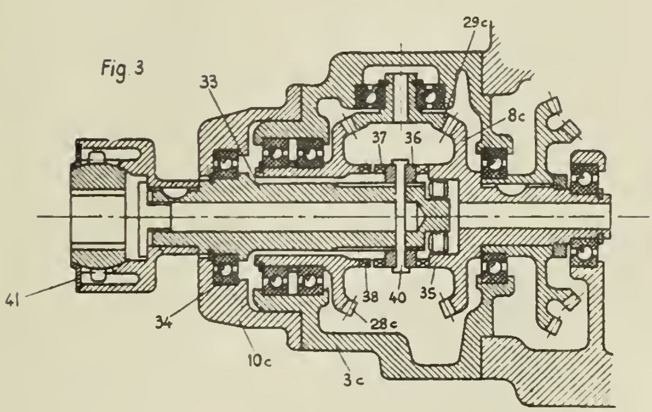


Fig. 3



Inventor
Charles Raymond Waseige
By Glascock Downing & Seebold
Attorneys

PUBLISHED

JUNE 15, 1943.

BY A. P. C.

C. R. WASEIGE
MULTI-DRIVE GEAR BOX FOR ACCESSORIES
ON BOARD AIRCRAFT
Filed May 27, 1942

Serial No.
444,734

3 Sheets-Sheet 2

Fig. 4

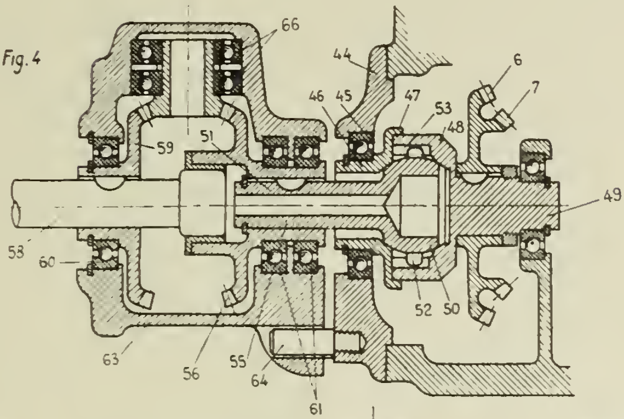


Fig. 10

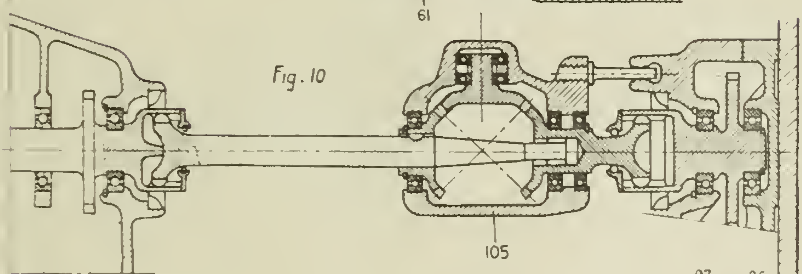
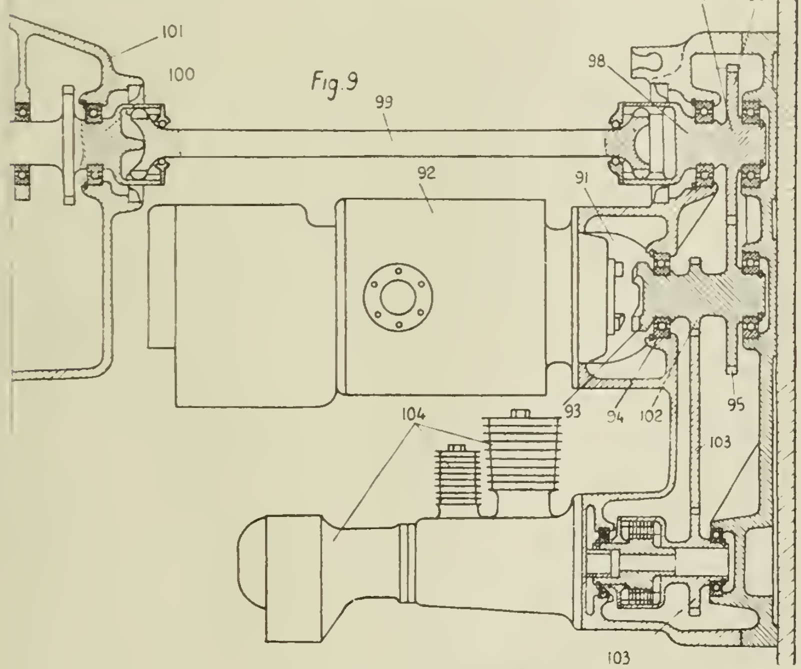


Fig. 9



Inventor
Charles Raymond Waseige
By Glascock Downing & Seebold
Attorneys

PUBLISHED
JUNE 15, 1943.
BY A. P. C.

C. R. WASEIGE
MULTI-DRIVE GEAR BOX FOR ACCESSORIES
ON BOARD AIRCRAFT
Filed May 27, 1942

Serial No.
444,734
3 Sheets-Sheet 3

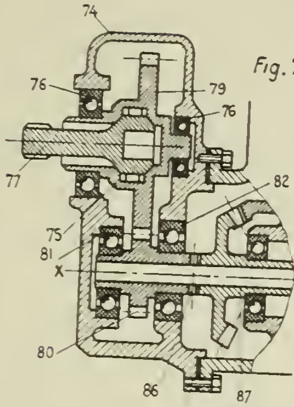


Fig. 7

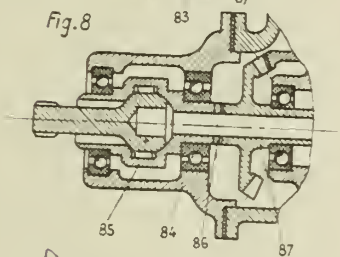


Fig. 8

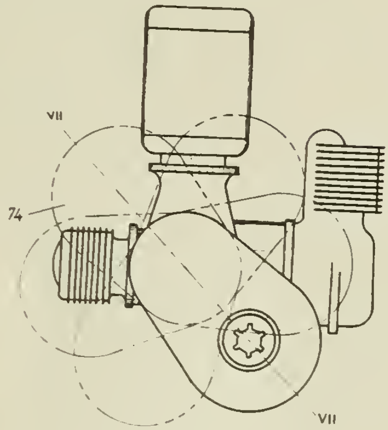


Fig. 5

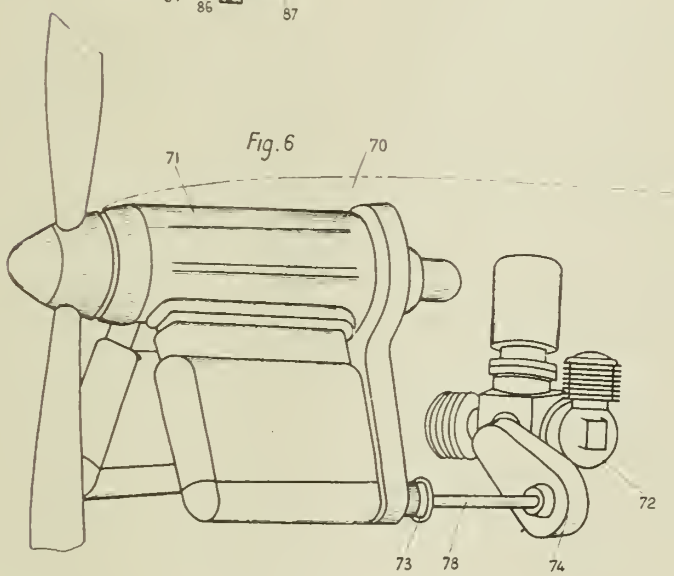


Fig. 6

Inventor
Charles Raymond Waseige
By Glascock Downing & Seebold
Attorneys

Published June 15, 1943

Serial No. 456,846

ALIEN PROPERTY CUSTODIAN

ELASTIC WHEEL

Armand Raymond Ernest André Perreau, Lyon, France; vested in the Alien Property Custodian

Application filed September 1, 1942

As is known, the trajectory of every moving vehicle should wherever possible approximate a straight line in order to satisfy requirements so far as the comfort of passengers and proper running conditions of the vehicle are concerned. Where the speed increases, such a condition becomes imperative especially if the ground is uneven or bumpy. The type of vehicle wheel which has given the best results in this respect heretofore is that having a rim provided with a pneumatic tire so as to absorb as it were the unevennesses of the road on which the vehicle travels. In order to obviate the risk of punctures or the call for rubber in the manufacture of tires, numerous elastic wheels comprising no inflatable air tube were devised but they all present more or less serious disadvantages.

The primary object of the present invention is to provide an elastic wheel of novel or improved construction capable of obviating the disadvantages of prior non-pneumatic tire wheels while lending itself to a process of manufacture utilizing no substantial quantity of rubber.

Another object of the invention is to provide a wheel comprising an elastic tire or tread made up of a plurality of resilient ring members shaped and juxtaposed so as to build a shock-absorbing annulus or torus and so interconnected as to cause any reactive stress imparted to said annulus by an impact from the ground to be distributed to neighboring ring members whereby a substantial portion of the torus partakes in the balancing of said reactive stress.

A further object of the invention is to provide a wheel comprising an elastic tire or tread made up of a plurality of ring members so interlinked as to cause oscillations derived from an impact of the ground on said tire to be cushioned and damped down by a self braking action so as to prevent said oscillations from being propagated to the whole of the tire.

A still further object of the invention is to provide a wheel comprising an elastic tire or tread made up of a plurality of ring members so interlinked by adjustable connecting means as to allow the cushioning effect of said ring members to be regulated to cope with the load to be carried or the condition of the road, the adjustment thus performed being analogous to the varying degree of inflation of a pneumatic tire.

Still a further object of the invention is to provide an elastic structure as aforesaid possessing resiliency both radially and in a lateral direction, said structure being utilisable either as a complete wheel or as a resilient tire or tread adaptable to existing wheels belonging to types having rigid or semi-rigid treads.

With these and such other objects in view as will incidentally appear hereafter, the invention comprises the novel construction, combination and arrangement of parts that will now be described in detail with reference to the accompanying diagrammatic drawings illustrating embodiments of the same and forming a part of the present disclosure.

In the drawings:

Figure 1 is a fragmentary elevational view partly in section along a plane extending on the line 1—1 of fig. 2 at right angles to the axis of the wheel hub.

Figure 2 is a fragmentary elevational view partly in section on the line **2—2** of fig. 1 showing the geometrical projection of one of the ring members included in the wheel structure on a plane extending along the major axis of the wheel hub.

Figure 3 is a separate enlarged view showing a turnbuckle device for adjusting tension on the links or rods that interconnect the ring members involved in the wheel structure.

Figures 4 and 5 are views on a smaller scale similar to fig. 2 showing constructional modifications of the ring members.

Figures 6 and 7 are further views similar to figs. 4 and 5 showing as developments of the invention other constructional modifications of the ring members, assuming each of the latter to be made up of a pair of elements.

Figure 8 is a view similar to fig. 1 showing a further constructional form of the wheel.

Figure 9 is a view similar to fig. 1 showing the form illustrated in fig. 8 and an additional rubberized cloth tread over the ring members as well as side coverings therefor.

Figure 10 is a view drawn on the same scale as figs. 4 to 7 but showing a construction modification wherein the wheel tire or tread has a twin structure, i. e. comprises a pair of ring member assemblies arranged in parallelism.

Like reference characters designate like parts throughout the several views.

Reference being first had to the constructional form shown in figs. 1 and 2, it will be seen that the elastic wheel or tire structure comprises a plurality of ring members *a* arranged side by side substantially parallel to the wheel axis and interconnected by arcuate links such as rods *b* circumscribing the rim and arranged at intervals along the internal outline of said ring members

so that under ground impacts such members may be temporarily distorted in innumerable planes.

In the embodiment shown, eight links or rods *b* are provided but such a number is not limitative. Advantageously, the ring members *a* are made of resilient wire (for example steel wire) which may have any convenient cross sectional shape: circular, oval, rectangular or another shape.

Some of the rods *b* are loosely engaged through fastening members such as U-shaped shackles *c* clamped upon the wires *a*, while other rods *b* are engaged through loops *d* formed on the innerly disposed adjacent ends of the wires *a*.

The end portions of the wires or ring members *a* are bent at a^2, a^3 (see Fig. 2) to present outer concavities matching corresponding convexities formed respectively on a rim *e* and a companion rim flange e^1. The rim *e* is integral with the wheel disk plate *f* to which the rim flange e^1 is bolted at e^2.

Each rod *b* is advantageously made in two sections as shown in Fig. 3, said sections having loosely interfitting ends b^1, b^2 and being pivotally interconnected by a chordal turnbuckle device shown diagrammatically and including a nut *g* by which the degree of interfit may be set to vary the tension of the rods *b* and wire assembly and thus match requirements. It will be understood that as the nut *g* is so rotated as to bring the rod male end b^1 further into the rod female end b^2, the diameter of the entire circular rod *b* is lessened and the resiliency of the assembly of wires *a* is correspondingly altered. Therefore by adjusting the turnbuckle means provided on the wire connecting rods *b*, an action somewhat similar to that achieved when more or less inflating a pneumatic tire may be obtained.

An elastic system made as above described forms a self damped and self contained structure. The damping action results from the mutual frictions of the wires *a* and rods *b*, while the self contained character results from the bent, looped or counter-elbowed outlines which are given to the flank portions of the ring members *a* to cause them to rub or abut against one another, particularly in a plane at right angles to the wheel axis.

One feature of the wheel resides in the possibilities of deriving the desired resiliency from the flank portions of the ring members *a* either by resorting for example to counter-elbowed or chevron outlines as shown in Fig. 1 or by giving said flank portions a convex outline as shown in Fig. 4 or a concave outline as shown in Fig. 5 or else by giving said flank portions looped shapes as shown as a^4 in Figs. 7 and 8.

Moreover, as each ring member is the essential resilient component of the elastic wheel, it may be shaped in different ways from a single wire, cord or the like or from a pair of wires, cords or the like as shown for example in Figs. 6 and 7 where two wire elements a^1 are coupled at their outer ends as at *i* and are abutted at their inner ends to correspondingly shaped rim portions. The coupling of the wire elements a^1 at their meeting ends may be performed by any means such as by soldering, welding, brazing or otherwise.

In the constructional form shown in Figs. 8 and 9 wherein the flank portions of the separate wire elements a^1 are provided with internal loops a^4, the ring members are interconnected by rod links b^3, b^4, b^5 and washers or bushings *h* (Fig. 8) bestow proper rigidity upon the assembly in view of its adaptation to a rim of known construction. A set of plates *i*, *j* (Fig. 9) clamped by means of tightening bolts *k* facilitates the assembly of the wire elements or ring member halves a^1.

This constructional form also comprises an additional tread *m* which may be advantageously formed of a multiply rubberized cloth or an equivalent attrition resisting material. It further comprises a pair of flexible coverings such as *o* which protect the flank portions of the flexible ring members a^1 and are secured to the ends of the tread *m* and to rim flanges *p*, p^1. The coverings o may be made of any yielding or flexible material such for example as rubber, leather, rubberized cloth or gauze. They shroud the assembly from dirt, grit and similar detrimental actions.

An advantage worth mentioning of a tread such as *m* is that while protecting the assembly it also distributes reactive stresses due to ground impacts to the several ring members to whose outermost portions it is fastened in any suitable manner. A tread such as *m* is advantageously endowed with anti-skidding properties and improves the running conditions of the vehicle particularly so far as its behavior on the road is concerned.

In the constructional modification shown in Fig. 10, the rim *e* is provided with two co-extensive parallel sets of ring members *a*, *a* each of which is built up as above described. An annulus *q* is provided on the rim *e* intermediate the adjacent ends of both ring member sets so that they can be properly abutted thereagainst.

It will be understood that the invention may be applied either to the construction of a complete wheel or to the construction of an annulus or torus having the aforesaid structure and adaptable to a readily made rim and hub assembly, in which case the torus will be used instead of a pneumatic tire.

It will be further understood that the words "wires" and "links" used in this specification must be construed in a broad sense as involving all equivalents. Thus the word "wires" also involves the meaning of cords and cables, while the word "links" involves the meaning of rods, bars and similar elongated members capable of playing the same function in resiliently interconnecting the ring members.

ARMAND RAYMOND ERNEST
ANDRÉ PERREAU.

PUBLISHED

JUNE 15, 1943.

BY A. P. C.

A. R. E. A. PERREAU

ELASTIC WHEEL

Filed Sept. 1, 1942

Serial No. 456,846

2 Sheets-Sheet 1

Fig.1

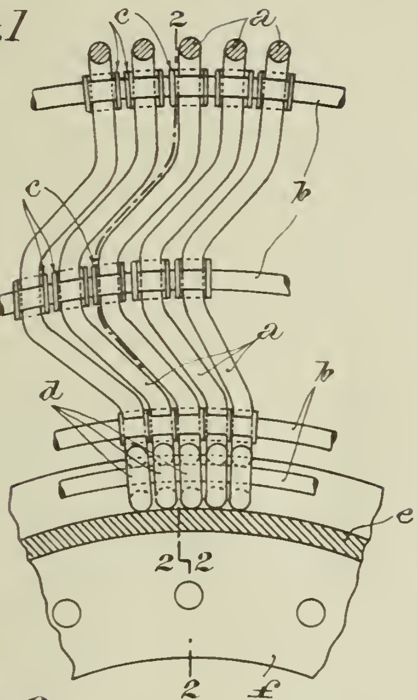


Fig. 2

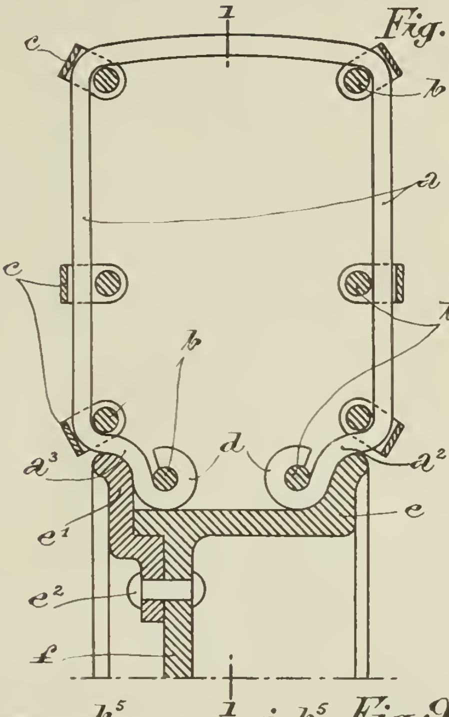


Fig.8

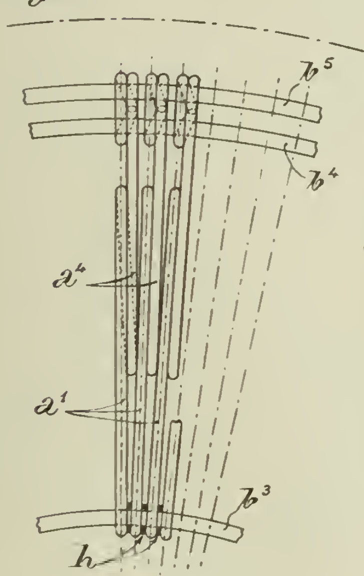
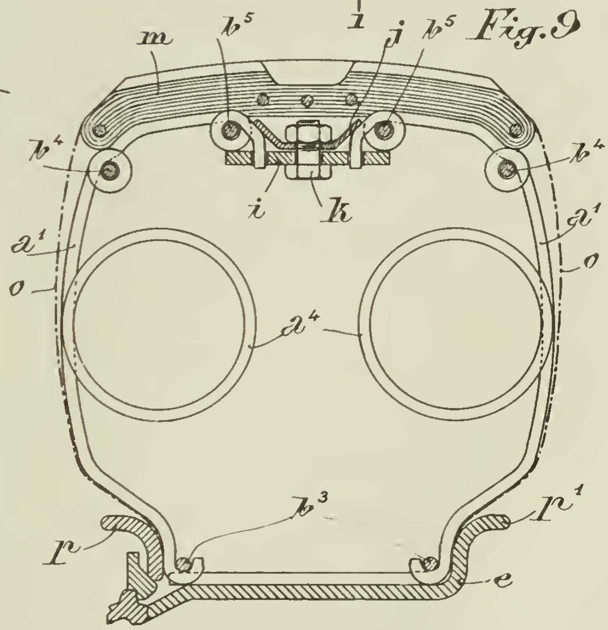


Fig.9



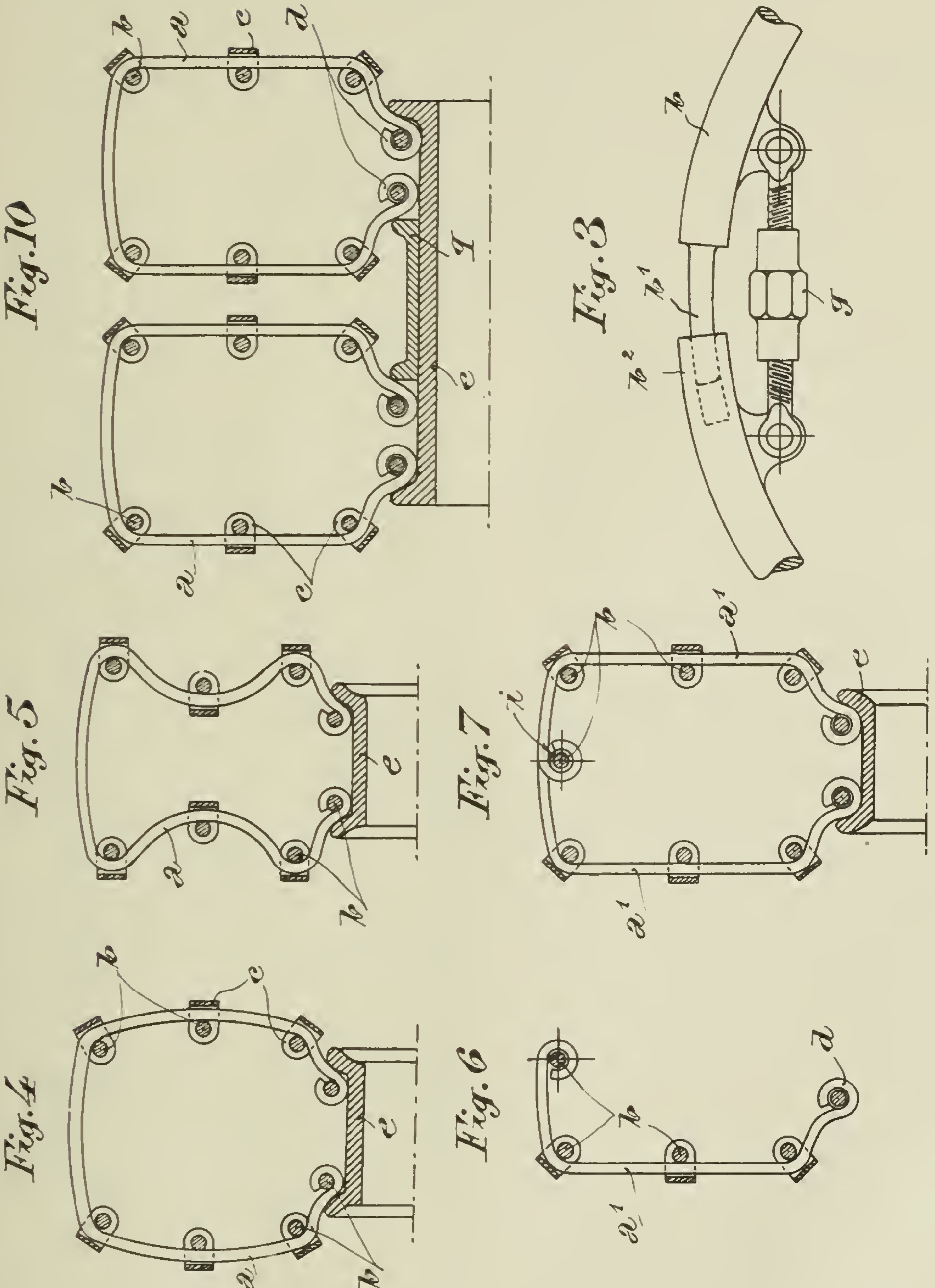
Inventor:
ARMAND RAYMOND ERNEST ANDRÉ PERREAU

By Haseltine, Lake & Co.
Attorneys.

PUBLISHED
JUNE 15, 1943.
BY A. P. C.

A. R. E. A. PERREAU
ELASTIC WHEEL
Filed Sept. 1, 1942

Serial No.
456,846
2 Sheets-Sheet 2



Inventor:
ARMAND RAYMOND ERNEST ANDRÉ PERREAU
By Haseltine, Lake & Co.
Attorneys.

Published June 15, 1943

Serial No. 727,832

ALIEN PROPERTY CUSTODIAN

PROCESS FOR THE PRODUCTION OF SALTS BY BASE-EXCHANGING SUBSTANCES

Henry Johnsen, Notodden, Norway; vested in the Alien Property Custodian

Application filed May 26, 1934

The present invention relates to a process for the production of salts by means of base-exchanging substances.

It is well known that certain aqueous salts containing silicic acid and alumina or alkali earth bases, especially minerals belonging to the zeolite group, and similar salts produced artificially—the so-called permutites—possess the property of being able to exchange their alkali or alkali earth bases with other bases. This base-exchanging property of the above mentioned substances has been utilized for rendering hard water soft, for freeing drinking water from certain bases and for the purification of salt solutions.

The most important feature of all these processes is that a salt solution or the water that is to be purified, is passed through a base-exchanging substance, for instance permutite composed of grains of a suitable size, whereby an exchange of bases is attained.

It has also been suggested that base-exchanging substances be used for the production of salts, the same principles being used as in the processes by which hard water is rendered soft and by which salt solutions are purified.

Base-exchanging substances for the production of salts have not as yet been employed to any great extent in industry, because, hitherto, only very weak solutions of the required salt have been obtained, and the evaporating costs have consequently been too high.

By means of the present invention this drawback can be remedied, because sufficiently concentrated solutions can be obtained by this process, thus rendering it possible, both technically and economically, to produce salts on a large scale by means of base-exchanging substances.

In order to give the best possible illustration of the process, and as an example of how it can be employed, it will be described in the following how sodium nitrate can be obtained from calcium nitrate and sodium chloride by means of permutite. The word "permutite" may be taken to means any suitable base-exchanging substance.

To commence with, one has a calcium nitrate and a sodium chloride solution, also permutite saturated with soda salts, in other words, sodium permutite. The permutite must be of a quality through which liquids easily penetrate, and must be composed of grains of a suitable size. It is placed inside a tower that is a few metres high and is deposited on a perforated plate or the like. The major part of the space in the tower is occupied by the permutite, which forms a horizontal surface at the top. In the upper part of the tower there are devices for the liquid supply, and at the bottom there are outlet devices, through which the liquid may be discharged.

When starting the process, the tower is filled with water that is free from air, until it reaches just above the surface of the permutite. The best way of carrying out the first filling process is to press the water slowly through the permutite from below, thus eliminating all air from the permutite.

In order to avoid the formation of air bubbles while the process is in operation, all the liquids supplied to the tower are first rendered free from air to the greatest possible extent, for instance, by placing them under vacuum. Air bubbles have the effect of stopping the activity of the permutite, and causing disturbances in the regular movements of the various layers of liquid (see later). Owing to the fact that vacuum sometimes occurs in certain parts of the tower, air bubbles may be formed, if there is any air at all even in the form of a solution, in any of the liquids that pass through the permutite. From this it will be seen how very important it is that the liquids are free from air. By means of suitable devices care is taken that the level of the liquid remains practically stationary through the entire process, that is to say, just above the surface of the permutite. When the apparatus is in operation, the permutite will thus remain in liquid all the time. For supplying the liquids while the process is in operation, a suitable spraying device is installed in the top of the tower, having several outlets just above the surface of the layer of permutite and evenly distributed above it, but under the level of the above mentioned liquid.

After the tower has been filled with water, a concentrated calcium nitrate solution is supplied through the aforementioned sprayers to the layer of sodium permutite. The solution is evenly distributed over the surface of the permutite and sinks downwards, displacing on its way a corresponding quantity of water, which runs away at the bottom of the tower. During this process, the calcium from the nitrate solution gradually penetrates through the permutite, calcium permutite being formed, whilst sodium in equivalent proportions is forced out of the permutite, sodium nitrate being formed in the solution. It is a characteristic feature of the present process that during the operation thereof an equally large quantity of liquid is discharged from the bottom of the tower as that which is supplied to the permutite at the top of the tower.

At this state in the process there is a nitrate

solution on top and clean water just beneath it, and the liquids move gradually downwards through the permutite. When a suitable period has elapsed, the supply of calcium nitrate solution ceases, clean water being supplied through the sprayers instead. After a certain time there will thus be three different layers in direct connection with each other moving downwards through the permutite, viz. first water, then the nitrate solution and finally water. As the nitrate solution now comes continually into contact with sodium permutite that has not been converted, it will gradually become more enriched with sodium nitrate, whilst the quantity of calcium nitrate decreases. After clean water has been supplied at the top of the tower for a brief period, the water is turned off, and a sodium chloride solution is added, this having the effect of regenerating the used permutite. As the regeneration must be as thorough as possible, a considerably larger quantity of this solution is used than of the nitrate solution. The difference in volume becomes still more marked, if a diluted sodium chloride solution is used, for instance sea water, which we have found can be employed for this purpose.

Under the assumption that a sufficiently high tower is used, the following layers of liquid pass through the permutite, counted from the top to the bottom: (1) chloride solution, (2) water, (3) nitrate solution, (4) water.

By degrees, as the layers move through the permutite, the quantities of Ca in the chloride solution and of Na in the nitrate solution increase. After the water has been discharged from the bottom of the tower, the nitrate solution flows down and is collected and evaporated, whereby the sodium nitrate is crystallised out. The mother liquor which chiefly contains calcium nitrate, and to which fresh quantities of calcium nitrate may possibly be added, is re-employed in the process.

The reason why a layer of clean water is inserted between the nitrate solution and the chloride solution is because this prevents the solutions from becoming intermingled. Consequently, the layer of water must be so high that those chlorine ions and nitrate ions that diffuse into the water from each side do not reach the middle of the layer of water by the time it gets to the bottom of the tower. In other words, there must still be some clean wtaer left in the middle of the layer.

When collecting the nitrate solution, it will be possible to prevent any loss of nitrate by collecting at the same time half of the layer of water.

In order to avoid too great a dilution of the nitrate solution, such large quantities of water are not generally employed that complete separation of the nitrate solution and the chloride solution is obtained. The extent to which this is done largely depends upon how pure a quality of salt is required.

The chloride solution, which contains calcium chloride, obtained after the regeneration of the permutite, is also collected separately and evaporated, whereby calcium chloride and sodium chloride are obtained, these being re-employed in the process.

If sea water is used for regeneration purposes, the solution becomes so diluted that it is generally considered worthless and is allowed to run to waste.

When the sodium chloride solution has been supplied to the permutite at the top of the tower for such a long time that the latter has become regenerated, clean water is again turned on, thereupon the nitrate of lime solution, then water, and then again the sodium chloride solution etc. as described above.

In this manner it is possible, by means of the permutite and a sodium chloride solution, for instance sea water, to convert nitrate of lime into sodium nitrate in a continuous process.

Example

A cylindrically shaped tower of an internal diameter of 1.5 metres is filled with permutite placed on a perforated plate. The height of the layer of permutite is 6.4 m., and the gross volume thereof is 11.3 cubic metres. When the tower is filled with liquid, which just reaches above the permutite, the volume of the liquid is 80 per cent of the gross volume of the permutite, or—in other words—it is 9.05 cubic metres.

At the commencement of the experiment the permutite consists of sodium permutite, and the tower is filled with water so that it covers the permutite.

First, 2.11 cubic metres of calcium nitrate solution containing 52 gr. of $Ca(NO_3)_2$ per 100 cubic cm., that is 1100 kilos of $Ca(NO_3)_2$ in all, is supplied at the top of the tower, and while this is in progress, 2.11 cubic m. of water is discharged from the bottom of the tower.

Immediately the supply of nitrate solution ceases, 1.45 cubic m. of water is supplied at the top of the tower, and directly after that, 4.75 cubic m. of sodium chloride solution containing 26 gr. of NaCl per 100 cubic m., that is 1230 kilos of NaCl in all. Immediately after that, 1.6 cubic m. of water is supplied, then again 2.11 cubic m. of calcium nitrate solution. All the liquids supplied at the top of the tower pass through the permutite at a speed of 5 metres per hour. While passing through the permutite, salt from the solution diffuses into the layers of water. In the present case, the volume of water which was in the tower at the commencement of the experiment was 9.05 cubic m. Had there been no diffusion, 9.05 cubic m. would have been discharged from the bottom of the tower before the first nitrate ions could have been detected in the outlet, and the whole of the nitrate solution would have been contained in the same volume as before, i. e. 2.11 cubic m. which could easily have been collected separately in the form of a nitrate solution.

Instead of allowing 9.05 cubic m. of water to flow away before collecting the nitrate solution, the collection thereof is begun—on account of the diffusion—as soon as 8.325 cubic m. has flown away, that is to say 0.725 cubic m. of the liquid is taken out prior to the original volume of the nitrate solution. Likewise, 0.725 cubic m. is removed after the original volume. In other words, 0.725 cubic m.+2.11 cubic m.+0.725 cubic m. is collected, this equalling 3.56 cubic m., in the form of a finished nitrate solution.

The attached diagram shows, schematically, the conditions prevailing in the tower at the moment the collection of the nitrate solution commences.

The collected nitrate solution (3.56 cubic m.) contains 728 kilos of NaNO , 312 kilos of $Ca(NO_3)_2$ and 7 kilos of NaCl. Thus, about 70 per cent of the quantity of nitrate present in the solution is composed of sodium nitrate. About 5 per cent of the nitrate ions supplied are lost on account of the diffusion.

When evaporating the nitrate solution, about

90 per cent of the sodium nitrate present is obtained by crystallization. The mother liquor is then re-employed in the process as a nitrate charge.

Directly the nitrate solution has been collected, 0.725 cubic m.+4.75 cubic m.+0.725 cubic m. equalling 6.2 cubic m. is collected in the form of a chloride solution. From the latter, calcium chloride can be produced. The sodium chloride thereby obtained is re-employed in the process for regeneration of the permutite.

The quantity of water supplied at the top of the tower after the sodium chloride solution may easily be greater than 1.6 cubic m. This is especially advantageous when desiring to produce nitrate that is as free as possible from chloride, because the greater the quantity of water used, the more effective is the washing out of the chloride from the permutite.

When large quantities of water are supplied between the solutions, the middle part of the volume of water that is free from salt is allowed to run to waste, the first and last parts being collected together with the adjoining solutions; by this means it is possible to avoid unnecessary dilution of the solutions.

Instead of only one tower, it is also possible to use two towers or more. This is particularly advantageous when the sodium chloride solution used consists of sea water. In this case, extremely large quantities of sea water are needed for the regeneration process. The process can then be carried out advantageously in the following manner:

The regeneration is effected in one or more towers at a time by conducting sea water through the tower or towers at a speed that is several times as high as that at which the solutions or layers of water respectively pass through other towers, in which the conversion of the $Ca(NO_3)_2$ into $2NaNO_3$ simultaneously takes place.

When using several towers, higher degrees of concentration of the nitrate are attained, provided only the middle, most highly concentrated part of the solution obtained from the tower is collected, the less concentrated parts—coming before and after the middle part—being used as admixtures in the other towers before and after a fresh supply of nitrate solution. By this means, it is possible to avoid any loss of nitrate.

When several towers are employed, the degree of conversion can be heightened by the following method:

The portion of nitrate solution supplied to a tower is made say three times as large as that which is suitable, when only one tower is employed. Only the first, more thoroughly converted part of the solution is collected as a finished solution after conversion has taken place in the tower, whereupon the remainder or a suitable part thereof is conducted to another tower containing newly regenerated permutite. To this tower a concentrated calcium nitrate solution that has not been converted is then immediately supplied.

This can be repeated several times so that from tower No. 2 only the first, more thoroughly converted, part of the solution is collected, the remainder or a suitable part thereof being transferred to tower No. 3, containing newly regenerated permutite etc. The degree of conversion will thus rise as nearly as possible to the state of equilibrium.

By combining the two last mentioned methods, it is possible for the collected finished nitrate solutions to attain the highest possible degree of concentration and the highest possible degree of conversion.

Contrary to previously known methods, it is not the chief aim of the present process to attain complete conversion by means of the exchange of bases. It has, in fact, been found to be perfectly sufficient for an economic effectuation of the process, if conversion of 60 per cent is acquired.

The permutite is not absolutely insoluble under the conditions described above. A part of it, therefore, becomes lost during the operation of the process. The solubility and consequently the loss is dependent upon the salt content in those liquids which pass through the permutite, and it is therefore the clean water that dissolves the greater part.

It further appears that the silicic acid in the permutite is more easily dissolved than the aluminium oxide, and this applies both when the permutite is in water and when it is in salt solutions.

We have ascertained that the loss of permutite can be reduced practically to nil, if a small quantity of a soluble silicate, for instance sodium silicate, is admixed to the water used in the process. Silicate can also be admixed to the solutions used, provided they do not already contain a sufficient quantity of silicic acid. It is especially advantageous to admix silicate to the sea water used for the regeneration of the permutite in the production of sodium nitrate.

We have found it sufficient, in order to reduce the loss of permutite to a minimum, to admix such a quantity of silicate that the water, and preferably the solutions too, contains 5–6 mgr. of SiO_2 per litre.

As it will be understood, the process described above can be used for a wide range of different salts, provided the salts cannot react with each other, unless base-exchanging substances are used. In the example described above, sodium chloride and calcium nitrate are used, which do not generally, that is to say, without the application of base-exchanging substances, react with each other to form sodium nitrate or calcium chloride with such a yield that the process is practicable from a technical point of view.

HENRY JOHNSEN.

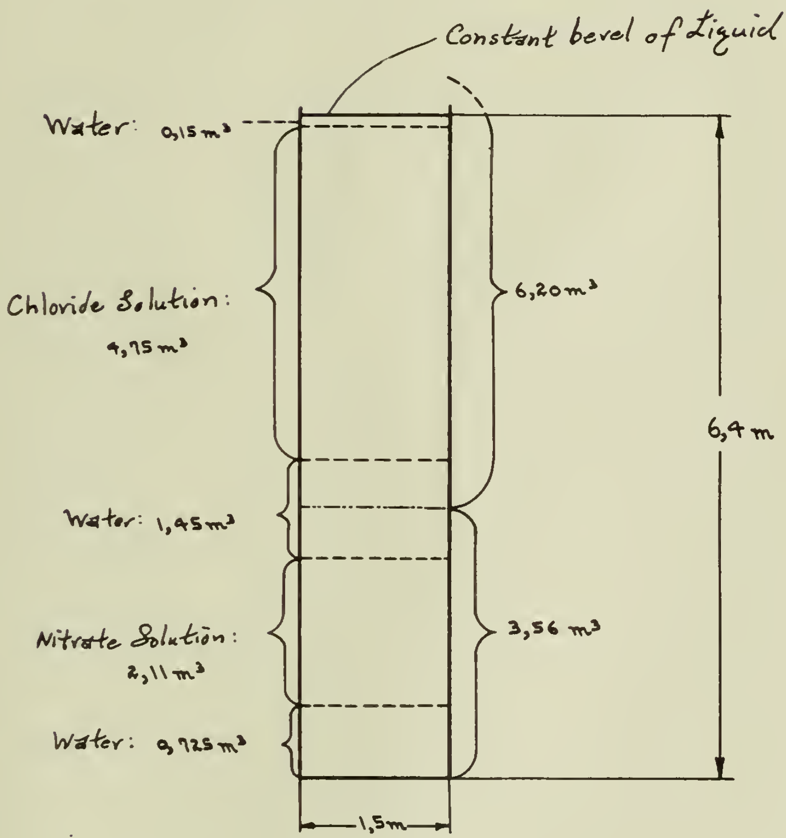
PUBLISHED

JUNE 15, 1943.

BY A. P. C.

H. JOHNSEN
PROCESS FOR THE PRODUCTION OF SALTS
BY BASE-EXCHANGING SUBSTANCES
Filed March 26, 1934

Serial No.
727,832



H. Johnsen
INVENTOR

By: Marks & Clerk
Attys.